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CHAPTER 1
GENERAL CONSIDERATIONS

1-01 AUTHORITY

The Engineering Design and Development Standards, commonly known as "the EDDS," consist of the 3rd Edition, published in June 2003, with revisions issued in 2004 and 2009. A subsequent revision of Chapters 1, 4, 5 and 8 was made in 2010 pursuant to Snohomish County Code (SCC or County Code) 30.63A.120 to comply with and implement the requirements of the County's National Pollutant Discharge Elimination System (NPDES) Phase 1 Municipal Stormwater Permit.

Chapter 36.80 of the Revised Code of Washington (RCW) charges the County Road Engineer with the responsibility to prepare standards of construction for roads and bridges. Chapter 13.05 SCC authorizes the Snohomish County Engineer to adopt and amend the EDDS in accordance with that title and sound engineering practices. SCC 13.05.020 specifies that the EDDS shall govern all new construction and upgrading of transportation facilities, storm drainage facilities and utilities within county rights-of-way, whether occurring under permit or franchise, and other transportation-related improvements mandated by Snohomish County land use codes. Accordingly, the EDDS is written to provide engineering standards for implementation of the authority assigned to the County Road Engineer, hereinafter referred to as "the Engineer," and the Director of Public Works.

1-02 PURPOSE

The purpose of these Engineering Design and Development Standards is to ensure that transportation, drainage and utility facilities constructed in Snohomish County meet appropriate standards for safety, construction, maintenance and water quality. These Standards are published in accordance with the Revised Code of Washington and accomplish the following:

- Provide clear and consistent design standards for construction or modification of transportation, drainage and utility facilities by public or private entities.
- Implement and administer the development regulations contained in Snohomish County Code and the Comprehensive Plan.
- Ensure the design and construction of facilities in the county right-of-way comply with all applicable laws, regulations and standards of good engineering practice.

1-03 APPLICABILITY

The Engineering Design and Development Standards shall govern all new construction, reconstruction and maintenance of transportation, drainage and utility facilities located in county rights-of-way, whether occurring under permit or franchise, and other transportation, drainage or utility facilities mandated by Snohomish County Code.

These Standards apply to both public and private projects to ensure compliance with county code and other regulations.

These Standards support and implement the following objectives of the General Policy Plan of the Snohomish County GMA Comprehensive Plan:

TR 1.A Prepare, in cooperation with the cities, the Washington State Department of Transportation (WSDOT), regional agencies, Sound Transit, Community Transit, and Everett Transit, standards for public transportation services and facilities consistent with adopted road standards, the land use element, and the natural environment element of the county's comprehensive plan.

TR 1.C Establish access and on-site circulation standards to maintain the safety and integrity of the arterial roadway system.

TR 1.D Regulate the design, location and public access of private access ways and roads that impact the public roadway.

TR 3.A Plan, design, program, construct, and promote use of non-motorized transportation facilities in Snohomish County and in cooperation with WSDOT and the cities.

TR 4.D Restrict direct vehicle access from public and private property onto designated principal and minor arterials to maintain and improve the integrity of traffic flow.

TR 4.E Provide and maintain transportation facilities that enhance the safety of motorized and non-motorized transportation.

NE 3.H Comply with the County's Phase I Municipal Stormwater Permit issued by the Washington State Department of Ecology pursuant to the Clean Water Act and the National Pollutant Discharge Elimination System (NPDES).

Situations may arise where the application of individual standards from this document will not ensure the protection of public health, safety and welfare. Accordingly, the Engineer may impose additional or more stringent standards than those contained in this document, or require the modification of plans, specifications or operations to achieve the necessary public health, safety and welfare. Modifications may include, but are not limited to scheduling, phasing or timing restrictions.

1-04 ADMINISTRATIVE INTERPRETATIONS AND REVISIONS

It is recognized that administrative interpretation of these Standards will be required from time to time. Such interpretations are refinements or explanations of meaning or intent issued by the County Engineer. Requests for administrative interpretations must be submitted in writing to the County Engineer.

The County Engineer is authorized to revise these Standards in accordance with SCC 13.05.010 and SCC 30.63A.120, and sound engineering practices. Such revisions will be issued as necessary to keep the document current and reduce the scope of subsequent changes. Each EDDS revision will incorporate the administrative

interpretations that have been issued since the last revision. Suggestions for future revisions may be submitted in writing to the Engineer using the form provided in Appendix A.

1-05 DEVIATION FROM STANDARDS

These Standards represent appropriate practice under most conditions, based on past experience in Snohomish County and other jurisdictions. They are intended to provide transportation, drainage and other engineering-related facilities that are safe and appropriate for use in Snohomish County.

Engineering design is an endeavor that examines alternative solutions to real world situations. These Standards are not intended to limit the introduction of new ideas. Situations will arise where alternatives to these Standards may better accommodate existing conditions, overcome adverse topography or allow for more cost-effective solutions without adversely affecting vehicle or pedestrian safety, operation of road or drainage systems, maintenance, environmental protection or aesthetics.

Accordingly, the Engineer will consider requests for deviations from these Standards; however, deviations from Chapter 5 drainage standards shall be processed as "modifications" or "waivers," as applicable, in accordance with chapters 30.63A and 30.86 SCC. Deviations required to implement low impact development (LID) shall be processed in accordance with chapter 30.63C SCC.

Deviation requests must be submitted in writing, using the Deviation Request Form provided in Appendix A, and include supporting information demonstrating compliance with the following criteria:

- The deviation will achieve the intent of these design standards;
- The deviation will not adversely affect safety or operations;
- The deviation will provide substantially equivalent environmental protection;
- The deviation will not adversely affect maintenance and its associated cost; and
- The deviation will not adversely affect aesthetic appearance.

A separate deviation request must be submitted for each standard that is proposed for deviation, except where the standards are related and should be evaluated as a single proposal. In such case, a single deviation request may be submitted but complete documentation and justification are required for each standard to be considered.

A deviation request is not required for any of the following circumstances:

- To approve a design that exceeds an EDDS specification, as determined by the Engineer;
- To approve an alternative standard provided in the EDDS; or
- To obtain an "Interim EDDS Administrative Interpretation" of a standard or specification.

It is recognized that the need for and timing of a deviation request may not be predictable. Requests should be submitted as soon as the need becomes known. This may prevent wasted effort in the preparation of plans with non-standard features that cannot be approved. Known deviation requests that affect a project's lot yield, density, or scope must be submitted prior to the SEPA decision or the final administrative decision on the application. This is important for environmental assessment, public notice and participation in the decision process.

Any deviation request concerning a provision of the Uniform Fire Code requires concurrence by the Snohomish County fire marshal prior to the final decision on the request.

The Engineer is the final authority on all EDDS deviation requests. The Engineer reserves the right to direct or deny a deviation from these Standards, at any time, in the interest of public health, safety and welfare. Reconsideration of the Engineer's decision may be requested, provided it is submitted in writing within 15 calendar days following the date of the original decision. The grounds for seeking reconsideration are limited to the following:

- The Engineer's findings, conclusions or conditions are not supported by the record;
- New evidence is discovered, which could not reasonably have been produced and is material to the decision; or
- Changes to the application are proposed in response to deficiencies identified in the original deviation decision.

1-06 POLICIES

These Standards are intended to be consistent with the following federal and state laws, county codes, policies and rules:

A. Snohomish County Code (SCC)

B. Snohomish County Drainage Manual

C. Snohomish County GMA Comprehensive Plan, General Policy Plan, and Transportation Element

D. Snohomish County GMA Subarea Plans

E. Snohomish County Arterial Circulation Map

F. Washington State Shoreline Management Act

G. National and State Environmental Policy Acts

H. Americans with Disabilities Act (ADA)

I. Federal Clean Air and Clean Water Acts

J. Department of Public Works' policies and procedures

1-07 REFERENCES

A. General

In the event these Standards and other applicable rules adopted by Snohomish County do not provide necessary design information, the following publications of the Washington State Department of Transportation (WSDOT) may be referenced:

- Standard Plans for Road, Bridge and Municipal Construction ("Standard Plans")
- Standard Specifications for Road, Bridge and Municipal Construction ("Standard Specifications")
- Bridge Design Manual
- Construction Manual
- Design Manual
- Hydraulics Manual
- Highway Runoff Manual
- Roadside Manual
- Traffic Manual
- Utilities Manual

The following references may also be applicable:

- WSDOT Local Agency Guidelines
- WSDOT "Sidewalk Details - A Guide for Washington Local Agencies, Tribes and Nations"
- Transportation Improvement Board (TIB) Guidelines
- Design criteria of federal agencies including the Federal Housing Administration, Department of Housing and Urban Development and the Federal Highway Administration, Department of Transportation
- A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO)
- LRFD (Load Resistance Factor Design) Bridge Design Specifications (AASHTO)
- Standard Specifications for Highway Bridges (AASHTO)
- Guide Specifications for Design of Pedestrian Bridges (AASHTO)
- Manual on Uniform Traffic Control Devices (MUTCD), (U.S. Department of Transportation, as amended and approved by WSDOT)
- Roadway Lighting Handbook, "Intersection Lighting Evaluation" (Implementation Package 78-15, U.S. Department of Transportation)
- ADA Accessibility Guidelines for Buildings and Facilities (ADAAG, US Department of Justice)
- Snohomish County Utility Accommodation Policy (County Council Motion 92-417, 1992)
- Hydraulic Code Rules (Chapter 220-110 WAC)

- Dam Safety Guidelines (Dam Safety Division, Washington State Department of Ecology)
- Roadside Design Guide (AASHTO)
- A Guide to Land Use and Public Transportation, Volumes I and II (Snohomish County Transportation Authority)
- Residential Streets, 3rd Edition (published by the American Society of Civil Engineers, National Association of Home Builders, and the Urban Land Institute)
- Residential Development Handbook for Snohomish County Communities (1992, Snohomish County Tomorrow)
- Model Code Provisions - Urban Streets & Subdivisions (September 1998, WSCTED)
- International Building Code (IBC, as amended and adopted)
- International Fire Code (IFC, as amended and adopted)
- Transit Oriented Development (TOD) Guidelines (July 1999, Snohomish County Tomorrow)
- Roadway Landscaping Standards (Snohomish County)
- Pedestrian Facilities Guidebook (September 1997, WSDOT, PSRC, CRAB and AWC)
- Fish Passage Design at Road Culverts (Washington Department of Fish and Wildlife, 1999)

In cases where these Standards conflict with the standards or procedures of the Washington State Department of Transportation (WSDOT) or the Federal Highway Administration (FHWA), the state or federal requirements shall take precedence for county road projects with state or federal funding.

1-08 ALTERNATE STANDARDS

Through Snohomish County Tomorrow (SCT), the County and the cities have developed uniform infrastructure standards to be applied to all land development inside unincorporated urban growth areas (UGAs). Minimum road/street standards were adopted by SCT in December 1999. Snohomish County will continue to work with SCT and the cities to implement mutually acceptable design standards.

A development inside an urban growth area (UGA) may be designed using elements of the associated city's engineering design standards. Such a request must be identified during the development review process. A deviation request must be submitted if the particular city standard is considered by Public Works to be a lesser standard than the county standard. The deviation request must be accompanied by a written statement from the city confirming the use and acceptability of the city standard. If the deviation request pertains to a standard in EDDS chapter 5 or the drainage or land disturbing activity requirements of chapters 30.63A or 30.63B SCC, then the deviation shall be processed as a code modification or waiver, as applicable, in accordance with chapters 30.63A and 30.86 SCC.

1-09 PERMITS

Other permits, approvals or agreements may be required by the County or other jurisdictions prior to initiating any activities subject to these Standards. Questions regarding such permits, approvals or agreements should be directed to the County Departments of Planning and Development Services or Public Works, as appropriate.

1-10 PLAN REVIEW

Plan review requirements for County-constructed road and drainage projects are governed by policies and procedures of the Department of Public Works.

For developer-constructed projects, all plans, reports, drawings and specifications that support permit or land use applications are to be submitted to Planning and Development Services. Copies of such supporting documentation are forwarded to the appropriate county staff for review.

Construction plan and profile drawings are required for all proposed road-related improvements, including storm drainage facilities and stream channel improvements. See Chapter 10 of these Standards for submittal requirements. Some projects may require that additional engineering data be submitted.

Engineering record drawings (previously known as "as-built" plans) for roads and drainage facilities must be submitted upon completion of construction and prior to final inspection approval. In some cases, these drawings will be required during the inspection process to approve facilities before the next phase of construction can proceed.

1-11 PROFESSIONAL QUALIFICATIONS

Professionals in the fields of engineering, architecture or surveying who prepare or are responsible for the preparation of plans, drawings, specifications, calculations, technical reports, etc., for the purpose of obtaining County permits or approvals, shall be registered or authorized to practice in the State of Washington in accordance with Title 18 RCW. Registration or authorization to practice shall be in the specific technical area pertinent to the documents being prepared. Exceptions to this requirement are specified in Section 18.43.130 RCW.

Chapter 30.66B SCC details special requirements for the preparation of traffic studies conducted for the purposes of that chapter.

1-12 INSPECTION

The Engineer shall have authority to enforce these Standards as well as other applicable specifications. The Engineer shall appoint personnel as appropriate to inspect work completed pursuant to these Standards; they shall exercise such authority as the Engineer may delegate.

It is the responsibility of the developer, contractor or their agents to have an approved set of plans and permits at the job site wherever work is being accomplished. If the plans cite these Standards without providing the specific text,

drawings or details, then a copy of these Standards must also be present at the job site. It is the responsibility of the developer, contractor or their agents to notify the County in advance of the commencement of any authorized work, in accordance with permit requirements.

If requested by the County, the applicant/developer may be required to provide tests to substantiate the adequacy and/or placement of construction materials.

1-13 SECURITIES

Securities and insurance may be required in accordance with County Code.

1-14 ERRORS AND OMISSIONS

At the discretion of the Engineer, any significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of the approvals and/or stoppage of any or all permitted work. It shall be the responsibility of the developer or contractor to show cause why such work should continue, and make such changes in plans that may be required by the Engineer before the plans are reapproved.

1-15 RIGHT-OF-WAY AND SITE MAINTENANCE

The developer or contractor shall schedule and control work so as to comply with all applicable provisions of Snohomish County land use codes and applicable state and federal codes, to prevent any hazards to public safety, health and welfare.

On existing roads, two-way traffic for vehicles, bicycles and pedestrians shall be maintained at all times unless detour plans or lane closures have been approved in advance by the Engineer.

Roads, bridges, bikeways, and pedestrian facilities shall be kept free of dirt, debris or any obstructions. Paved temporary detour(s) shall be provided during the entire time of repair or construction.

Pedestrian and vehicular access to occupied buildings shall be maintained except where written approval from the building owner has been obtained.

On-site grading shall be done in a manner to minimize off-site erosion and siltation in conformance with all statutory requirements, permits and approved plans.

1-16 PENALTIES

Failure to comply with these Standards will be cause for withholding or withdrawing approval of plans or drawings; withholding of bonds, final inspection approval or occupancy certificates; and/or other penalties as provided by county code or state law.

1-17 DEFINITIONS

AASHTO	American Association of State Highway and Transportation Officials.
Acceleration Lane	A speed change lane, including tapered areas, to enable a vehicle entering a roadway to increase its speed to a rate at which it can safely merge with through traffic.
Access Point	Residential or commercial driveway, connecting to the road system.
Access Ways	A collective term for various means of access to property that are neither public nor private roads. Typically privately owned and maintained. Examples include auto courts, drive aisles, woonerfs, etc.
ACP	Asphalt concrete pavement. May also mean the County's Annual Construction Program for Transportation.
ADA	Americans with Disabilities Act of 1991.
ADT	Average daily traffic. The total two-directional volume of traffic during a given time period (in whole days), greater than one day and less than one year, divided by the number of days in that time period.
Alley	An access way, typically privately owned and maintained, that provides vehicle access to garages behind residential dwelling units or service access to the rear of buildings.
Applicant	The person who has applied for or is requesting a permit, license or approval from Snohomish County.
Appurtenance	Equipment and/or accessories that are part of an operating system or subsystem.
APWA	American Public Works Association.
ASTM	American Society for Testing and Materials.
ATB	Asphalt-treated base.
Arterial	A transportation facility designated as an arterial in a UGA plan or the comprehensive plan.
Auto Court	A joint-use access way designed to be shared by vehicles, pedestrians and bicyclists within the same circulation space. With a typical maximum length of 150 feet, an auto court is not a through facility; it ends in a “court” used for garage access and other activities of the homeowners.
Auxiliary Lane	The roadway portion adjoining the traveled way for truck climbing, speed change or for other purposes supplementary to through traffic movement.
Backfill	Replacement of excavated material with suitable material compacted as specified.
Best Management Practices (drainage)	The schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State.

Best Management Practices (critical areas)	Physical, structural or managerial practices which have gained general acceptance by professionals in the appropriate field to minimize and mitigate adverse impacts to the functions and values of critical areas.
Bicycle or Bike	A vehicle propelled solely by human power upon which a person may ride, having two tandem wheels, except scooters and similar devices. "Bicycle" in this document may also be a three or four-wheeled, human-powered vehicle, but not a tricycle for children. A bicycle is considered a "vehicle" under Washington State Law.
Bicycle Facilities	Improvements and provisions to accommodate bicycling.
Bicycle Lanes	That portion of a roadway, which has been designated by striping, signing, and/or pavement marking for use of bicycles.
Biofiltration	Process of reducing pollutant concentrations in water by filtering through biological materials.
Bollard	A post, that may or may not be removable, used to prevent vehicular access.
Boring	Grade and alignment-controlled mechanical method of installing a pipe or casing under a road or stream without disturbing the surrounding medium.
Buffer	Area adjacent to a critical area consisting of naturally occurring or re-established vegetation and having a width adequate to protect the critical area.
Capacity	The maximum number of vehicles that have a reasonable expectation of passing over a given roadway, or section of roadway, in one direction during a given time period under prevailing roadway and traffic conditions.
Casing	A larger pipe enclosing a carrier for the purpose of providing structural or other protection to the carrier and/or to allow for carrier replacement without re-excavation, jacking or boring.
Catchbasin	A chamber or well, usually installed at the curb line of a road, for the transport of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
CBU	Cluster box unit. A multiple mailbox delivery unit approved by the US Postal Service.
Channelization	The separation or regulation of conflicting traffic movements into definite paths of travel by the use of pavement markings, raised islands or other suitable means to facilitate the safe and orderly movement of both vehicles and pedestrians.
Clear Zone	The total roadside border area, starting at the edge of traveled way, available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear run-out area. The desired width is dependent upon the traffic volumes, speeds, and the roadside geometry.

CMP	Corrugated metal pipe.
Commercial Use	A use providing goods, merchandise or services for compensation. Residential developments with three or more dwelling units (triplex and above) per parcel.
Compaction	The densification of a fill by mechanical means.
Conduit	Enclosed tubular runway for protecting wires or cables.
Construction Plans	Project drawings subject to county review and approval prior to construction that show the location, character and dimensions of the proposed work such as layouts, profiles, cross-sections, details, methods and general notes.
Conveyance System	A system of drainage facilities, natural or artificial, which collects, contains and conducts the flow of stormwater runoff. The elements of a natural conveyance system include, but are not limited to, swales, wetlands, drainage courses, streams, and rivers. The elements of an artificial conveyance system include, but are not limited to, gutters, ditches, pipes, constructed open channels and detention facilities.
Controlled Density Fill	A mixture of Portland cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material that will result in a hardened, dense, non-settling fill.
Control Zone	That roadside area defined by the "Control Zone Distance Table", found in Appendix 5 of the WSDOT Utilities Manual, within the road right-of-way in which placement of utility objects is controlled.
County Council	The Snohomish County legislative authority.
County Engineer, County Road Engineer, The Engineer	The County Road Engineer for Snohomish County with authority and duties as designated in RCW 36.75 and RCW 36.80, or his/her authorized designee. Also referred to as "the Engineer" herein.
Cover	Depth to top of pipe conduit, casing or gallery below the grade of a road or ditch.
Critical Area	The following areas and ecosystems: wetlands; areas with a critical recharging effect on aquifers used for potable water; fish and wildlife habitat conservation areas; frequently flooded areas; and geological hazardous areas.
CSBC	Crushed surfacing base course.
CSTC	Crushed surfacing top course.
Cul-de-sac	A road closed at one end, where the closed end is a circular or near circular shape providing a permanent turnaround.
Deceleration Lane	A speed change lane, including tapered areas, to enable a turning vehicle to slow to a safe turning speed after it has left the main stream of faster moving traffic.

Design Speed	A selected speed used to determine the various geometric design features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use, and the functional classification of the roadway. Used to determine Stopping Sight Distance and Intersection Sight Distance requirements for new roadways.
Design Storm	A rainfall event of a size approved by the Director, used for the purpose of sizing and designing drainage facilities, stated in terms of a recurrence interval and a time period over which the rainfall amount is measured or analyzed (i.e. a 2-year, 24-hour storm).
Detention	The temporary storage of stormwater runoff to control peak discharge rates and allow settling of stormwater sediment.
Detention Facility	An open or closed drainage facility, such as a pond or tank, that temporarily stores stormwater runoff and releases it at a slower rate than it is collected by the drainage facility. The facility includes the flow control structure, the inlet and outlet pipes, and all maintenance access points.
Developer	A property owner, or his/her agents or contractors, responsible for applying for or receiving a permit or approval for development.
Deviation	A modification of these Standards approved by the County Engineer.
DHV	Design hour volume. Hourly traffic volume used for road design and capacity analysis, usually one or more peak hours during a 24-hour period.
Director	The Director of the Snohomish County Department of Public Works or his/her authorized representative.
DPW	Snohomish County Department of Public Works.
Drainage	The collection, conveyance, containment or discharge of stormwater runoff.
Drainage Facility	A system of collecting, conveying and storing stormwater runoff. Drainage facilities include, but are not limited to, all stormwater conveyance systems, and containment facilities including pipelines, channels, dikes, ditches, closed depressions, infiltration facilities, retention facilities, detention facilities, stormwater treatment facilities, erosion and sedimentation control facilities, and other drainage structures and appurtenances, both natural and artificial.
Drainage Manual	The drainage manual adopted by the director of public works.
Drive Aisle	An internal vehicle circulation system of private access ways for the passage of vehicles which may include fire lanes, auto courts and roads that are owned in common by the property owners of a development that are not located in an access easement, tract or right-of-way.

Driveway	The area for the passage of vehicles to a parking area or structure on a lot. A driveway begins at the property line or edge of an access easement or drive aisle and extends into the site. A residential driveway shall not serve more than one detached single-family or one duplex structure.
Driveway, Common	A driveway that provides a single, common vehicle access for up to four dwellings.
Driveway, Shared	A driveway that provides a single, common vehicle access for two lots.
Easement	A right granted by a property owner to specifically named parties or to the public for the use of certain land for specified purposes. Where appropriate to the context, "easement" may also refer to the land covered by the grant. This may include access, pedestrian paths, bicycle paths, utility easements, drainage, native growth protection areas, resource protection areas or open space.
EDDS	The Engineering Design and Development Standards of Snohomish County, adopted by the Snohomish County Department of Public Works pursuant to Title 13 SCC.
Edge of Traveled Way	The face of curb for roads that are, or will be, constructed to urban standards or the outside edge of pavement (not including paved shoulders) for roads that are, or will be, constructed to rural standards.
Encroachment	Occupancy of county right-of-way by non-roadway structures or other objects.
Emergency Vehicle Signal	A special adaptation of a conventional traffic signal specifically installed to allow for the safe movement of authorized emergency vehicles. When not providing for the movement of emergency vehicles the signal shall either flash continuously consistent with the requirements for a conventional traffic signal or display continuous green (allowed at non-intersection locations only). At no time shall the system simply be de-energized. LED displays are required.
Engineer	See County Engineer.
Fire Lane	Also "Fire apparatus access road." Any road or driving surface, whether public or private, that is designed and constructed to meet the access requirements of the county fire code, Chapter 30.53A SCC.
Franchise	A document granted by the County authorizing the use of road rights-of-way by public or private entities, subject to specified conditions, in accordance with RCW 36.55, RCW 80.32 and Chapter 13.80 SCC.
Geometrics	The physical arrangement of the visible elements of a road such as alignment, grade, curvature, width, and side slopes.
Grade	Rate or percent of change in slope either ascending or descending from or along the roadway. Measured along the centerline of the roadway or access point.

Hazard	A side slope, an object, water, or a drainage device, which, if impacted, would apply unacceptable impact forces on the vehicle occupants, or place the occupants in a hazardous position. May be either natural or man-made.
HMA	Hot mix asphalt.
HOV Lane	A road or highway lane designated for the exclusive use of high occupancy vehicles and marked or signed accordingly.
Hyporheic Zone	The saturated zone under and adjacent to a river or stream, comprising substrate with the interstices filled with water.
Infill Development	The development of a parcel of land in a highly developed urban area.
Infiltration	Hydrologic process of stormwater runoff soaking into the subsoil, commonly referred to as percolation.
Intersection Sight Distance	Distance required for a driver of a vehicle traveling at or near the posted speed on the major road to reduce speed to avoid overtaking a vehicle which has entered the intersection from the minor road whether by right- or left-turning movements or crossings.
Island	A defined area between traffic lanes for control of vehicle movements and/or for pedestrian refuge.
Landing	Road or driveway approach area to any public or private road. Also, the level area at the back of the sidewalk ramp, typically 4 feet wide.
LID	Low impact development is a stormwater management and land development strategy applied at the parcel and subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic pre-development hydrologic functions.
Maintenance	Activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing and results in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. This does not include expansion in physical dimension, capacity or use.
Manhole	Opening in an underground utility system into which workers or others may enter for the purpose of making installations, inspections, repairs, connections, cleaning, and testing.
Median	That portion of a divided roadway separating the traveled ways for traffic in opposite directions.
MPH	Miles per hour.

MUTCD	The Manual on Uniform Traffic Control Devices, published by the U.S. Department of Transportation.
New Development	Land disturbing activities, including Class IV general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivisions, short subdivisions, residential condominiums, single-family detached units (SFDU), planned residential developments (PRD) and binding site plans. Projects meeting the definition of redevelopment shall not be considered new development.
Non-Motorized Transportation	Any mode of transportation that utilizes a power source other than a motor.
Operating Speed	The speed at which drivers are observed operating their vehicles during free-flow conditions. The 85th percentile of the distribution of observed speeds is the most frequently used measure of the operating speed associated with a particular location or geometric feature. Used to determine stopping sight distance and intersection sight distance for existing roadways.
P85 Speed or 85th Percentile Speed	The speed determined by a speed study, at or below which 85% of the drivers of a particular section of road will choose to drive and feel comfortable, based on the prevailing weather and traffic conditions.
Passing Sight Distance	The minimum sight distance required for the driver of one vehicle to pass another vehicle safely and comfortably.
Pavement	The combination of subbase, base course, and surfacing materials placed on a subgrade to support the traffic load and distribute it to the subgrade.
PC	Point of curvature. The point of change from a back tangent to a circular curve.
PCC	Portland cement concrete or point of compound curvature.
PDS	Snohomish County Department of Planning and Development Services.
Pedestrian	Person traveling on foot, in a wheelchair or similar device.
Pedestrian Facilities	Infrastructure and equipment to accommodate or encourage walking, including sidewalks, curb ramps, traffic control devices, trails, walkways, crosswalks, paved shoulders, and other design features intended to provide for pedestrian travel.
Permanent Road End	The physical termination of a roadway without potential for extension, based on the best available evidence at the time of evaluation. Typically a cul-de-sac.
Permit	A document or franchise authorized by the county.
PI	Point of intersection. The point of intersection of a back tangent and a forward tangent.
Pipe	Structural tubular product designed, tested, and produced for the conveyance of specific liquids or gases under specific conditions.

Planter strip or planting strip	A planter strip is that portion of right-of-way between the curb line and the sidewalk, or between the sidewalk and the right-of-way line, used for the planting of trees, shrubs, groundcover or grass.
Plowing	Direct burial of utility lines by means of a 'plow' type mechanism that breaks the ground, places the utility line at a predetermined depth, and closes the break.
Posted Speed	Maximum vehicle speed signed along a roadway.
Primitive Road	An unmaintained or privately maintained county right of way that meets the requirements of RCW 36.75.300. Typically, a primitive road has a gravel or earth driving surface, and an average annual daily traffic of one hundred or fewer vehicles. A primitive road must be established by County Council ordinance.
Private Road	Privately owned and maintained access provided for by a tract, easement or other legal means, typically serving three or more dwelling units.
PT	Point of tangency. The point of change from a circular curve to a forward tangent.
Radius Return Access Point	Intersection of an access point with a county road delineated by either pavement edges or curbs laid out at each edge in a curvilinear fashion between tangents formed by the edge of roadway (or curb face) and the edge of access point (driveway pavement or curb face).
Record Drawings	An approved final revision of a design drawing or plan updated to include information from field inspectors showing the true condition or configuration of what has been built. The drawing or plan is designated "Record Drawing" by stamp or lettering on the drawing and the primary function is to document what was designed and what was actually built, including dimensions, elevations, location and calculations. Formerly known as "as-built" or "as-constructed" drawings.
Redevelopment	The following activities that take place on a site that already has 35 percent or more existing impervious surface coverage: the creation of new impervious surface(s); structural development including construction, installation, expansion or replacement of a building footprint or other structure; replacement of existing impervious surface that is not maintenance; and land disturbing activity.
Relocation	Planned change of location of an existing facility to a more advantageous place. Character or general physical nature of the facility will not change.
Replacement	Installation of a like element of a utility system or subsystem in the same, or nearly the same, physical location normally due to damage, wear or obsolescence of the element.
Residential Property Use	Residential developments with two or less dwelling units (duplex or single family residence) per parcel. Consistent with building permit administration in Snohomish County which treats duplex or single family developments as residential building permit applications.

Restoration	All work necessary to replace, repair or otherwise restore the right-of-way and all features contained within the right-of-way to the same or equivalent condition as before.
Retention	The detainment of stormwater runoff in a basin without release except by means of evaporation or infiltration.
Retention Facility	An open or closed drainage facility, such as a pond or tank, that stores stormwater runoff without release except by means of evaporation, plant transpiration or infiltration into the ground. The facility includes the flow control structure, the infiltration system, the inlet and outlet pipes, and all maintenance access points.
Right-of-Way (R/W)	All property in which the County has any form of ownership or title and which is held for public road purposes, regardless of whether or not any road exists thereon or whether or not it is used, improved, or maintained for public travel.
Road	An open, public way for the passage of vehicles that, where appropriate, may include pedestrian, equestrian and bicycle facilities. Limits include the outside edge of sidewalks, or curbs and gutters, planter strips, paths, walkways, or side ditches, including the appertaining shoulder and all slopes, ditches, channels, waterways, and other features necessary for proper drainage and structural stability within the right of way. The term "road" is used interchangeably with "street".
Road End	The physical termination of the traveled way.
Roadway	Portion of a road, street or highway improved, designed, or ordinarily used for vehicular travel, exclusive of the sidewalk or shoulder even though such sidewalk or shoulder is used by persons riding bicycles.
Rural Area	Those areas of the county outside an urban growth area as depicted in the Snohomish County comprehensive plan.
SCC	Snohomish County Code.
Separate Turn Lane	An auxiliary lane for traffic in one direction, which has been physically, separated from the through traffic lane(s) by a traffic island or stripe. Frequently provided in one or more approaches to an intersection.
Shared Roadway	A roadway, without a painted bicycle lane, that does not prohibit bicycles.
Shared Use Path	A multi-use facility physically separated from the roadway, for bicyclists, pedestrians or other non-motorized users.
Shoulder	That portion of the roadway contiguous with the traveled way on the same level for accommodating bicycle and pedestrian travel, stopped vehicles, emergency use, and for lateral support of base and surface courses.
Sidewalk	A facility constructed between the curb line, in the lateral line of a roadway, and adjacent property set aside and intended for pedestrian use, or such portion of private property that parallels, and is in proximity to, a public roadway and dedicated for use by pedestrians. Sidewalks are typically constructed of concrete but may be asphalt.

Signed Shared Roadway	A roadway, designated by signing as a preferred route for bicycle use, with appropriate improvements such as widened shoulders.
Site	The area defined by the legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment including contiguous improvements in the right-of-way. For road projects, the lengths of the project site and right-of-way boundaries define the site.
Snohomish County Drainage Manual	See Drainage Manual.
Speed Change Lane	Separate lane to allow a vehicle entering or leaving a roadway to increase speed (acceleration lane), or decrease speed (deceleration lane) to a rate at which it can safely merge with, or diverge from, through traffic.
Stopping Sight Distance	Distance needed for a vehicle traveling at or near design speed to stop, prior to reaching a stationary object in its path.
Stormwater Facility	See Drainage Facility.
Stream	Those areas where naturally occurring surface waters flow sufficiently to produce a defined channel or bed which demonstrates clear evidence of the passage of water including, but not limited to bedrock channels, gravel beds, sand and silt beds and defined channel swales. A defined channel or bed means a water course that is scoured by water or contains deposits of mineral alluvium. The channel or bed need not contain water during the entire year. Streams do not include water courses which were created entirely by artificial means, such as irrigation ditches, canals, roadside ditches, or storm or surface water runoff features, unless the artificially created water course contains salmonids or conveys a stream that was naturally occurring prior to the construction of the artificially created water course.
Street	Used interchangeably with "road," especially in urban areas. See "Road" definition.
Swale	A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.
Temporary Road End	The physical termination of a roadway with potential for further extension typically ending in a temporary cul-de-sac or hammerhead turnaround.
Traffic	Movement of motorized and non-motorized vehicles, persons, cargo, and equestrians through the transportation network comprised of streets, roads, sidewalks, walkways and shared use paths.
Traffic Control	Those activities necessary to safeguard the general public, as well as all workers, during the construction and maintenance of roadway and other facilities within the right-of-way.
Traffic Engineer	Snohomish County Traffic Engineer.

Trail	Public way constructed primarily for, and open to, pedestrians, bicyclists and equestrians.
Trail Access Permit	A permit issued pursuant to Chapter 13.60 SCC to allow access to a legal lot via county right-of-way where no county-maintained road exists.
Traveled Way	That portion of the roadway intended for the movement of vehicles, including bicycles in bicycle lanes, but exclusive of shoulders.
Trip	A one-direction movement, which begins at an origin and ends at a destination.
Trip Distribution	The calculation and assignment of trips from a land development proposal to the surrounding road network.
Trip End	Each trip has two ends, the origin and the destination. Trip ends for a location are the summation of origins and destinations.
Trip Generation	The number of trips created by a particular land use or activity.
Ultimate Buildout	The development potential based on established GMA land use designations, taking into account existing developments and assumptions about environmental constraints and other limiting features.
Unmaintained Road	A road within county right-of-way that is accessible to public travel but is not maintained by the County.
Unopened Right-of-Way	A county right-of-way that exists by dedication or deed, but for which no vehicular roadway meeting these Standards has been constructed by the County or other parties.
Urban Area	Those areas designated by the County's comprehensive plans allowing densities of three dwelling units per acre (3 DU/acre) or greater, together with any adjacent areas designated as commercial or industrial. May also be defined as all land, regardless of current comprehensive plan designation, located within an urban growth area (UGA) officially adopted by the County Council pursuant to the State Growth Management Act, RCW 36.70A.
Urban Growth Areas (UGAs)	Those areas designated by the County after consultation with cities, where urban growth will be encouraged and supported by public facilities and services. The urban growth areas include areas and densities sufficient to permit the urban growth that is projected to occur in the county for a 20 year period. Urban growth refers to growth that makes intensive use of land for the location of buildings, structures, and impermeable surfaces to such a degree as to be incompatible with the primary use of such land for the production of food, other agricultural products or fiber or the extraction of mineral resources.
Utility	Any public or private entity whose principal purpose is to provide electricity, water, sewer, storm drainage, gas, radio, television, telephone and/or other forms of communication utilizing the electromagnetic spectrum to the public, except personal wireless telecommunications services.

Walkway	A facility designated for pedestrian and non-vehicular traffic. Walkways are typically constructed of asphalt and built over existing ground without being raised. Separation from vehicle traffic may be provided by pavement striping, extruded curb, ditch or open space.
Wetlands	Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, but are not limited to swamps, marshes, bogs and similar areas, as well as artificial wetlands intentionally created from non-wetland areas to mitigate for conversion of wetlands, as permitted by the County. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to irrigation and drainage ditches, grass-lined biofiltration swales, canals, detention facilities, wastewater treatment facilities, farm ponds and landscaping amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street or highway.
Window Cut	A rectangular cut in asphalt or concrete pavement (typically ranging in size from 4 square feet to 25 square feet) undertaken by a utility for repair of underground facilities or to install an underground service connection.
Woonerf	Dutch for “street for living.” A joint-use access way, widely used in Europe, that is designed for priority access by non-motorized users (pedestrians and bicyclists) and secondarily by motor vehicles.
WSDOT	Washington State Department of Transportation.

CHAPTER 2
ACCESS

2-01 ACCESS REQUIREMENTS

A. General

This chapter provides guidelines and standards for access, which are those facilities necessary for movement from private property to the county road system.

Vehicular access is provided by one or more of the following means:

- Public road
- Private road
- Other access ways - including fire apparatus access roads

Further discussion and design details for these options are contained in Chapter 3, "Road Design."

Access requirements for specific types of development are contained in the various development regulations of County Code. Access design and construction requirements are contained in Subsections 2-02 through 2-08 of this chapter.

Access for an individual lot is regulated by Snohomish County through the right-of-way (R/W) use permit process of SCC Title 13. No construction, alteration or relocation of an access point or related improvements is permitted without a valid permit.

Adjoining properties may be required to share an access through use of a joint access and circulation agreement.

B. Design

Access points shall be designed and constructed:

- to minimize conflicts between vehicles, bicycles and pedestrians.
- to avoid impacts to wetlands, streams, fish and wildlife habitat areas, buffers and other critical areas, to the maximum extent possible.
- to conform to ADA design requirements, where applicable.
- so that backing maneuvers from, or onto, a public right-of-way do not occur. This requirement does not apply to single family or duplex residential uses taking access from non-arterial roads. Under no circumstances shall an access point be designed so that backing maneuvers occur into an intersection of one or more arterial roads.

Design features, such as medians, channelization or curbing, may be required by the Engineer for control of traffic movements. The Engineer may determine, or require analysis to determine, if an access point must be designed to regulate traffic movements.

If a proposed development will discontinue use of one or more existing access points, these access points shall be removed by the developer and replaced with appropriate frontage improvements.

A temporary access point may be approved for undeveloped property if necessary for construction prior to completion of a final development plan. A temporary access point is subject to removal and reconstruction in accordance with the final development plan.

C. State Highway Access

Access to the State Highway system is regulated by Washington State Department of Transportation (WSDOT) or by local jurisdictions for highways within city limits. Permits and approvals for access must be obtained from the appropriate agency.

2-02 NUMBER OF ACCESS POINTS

The number of access points allowed for a parcel or development depends on the intended land use.

A. Residential

1) Urban parcels shall be allowed one access point per parcel, exclusive of alleys. A duplex, multi-family residential or single-family detached unit (SFDU) development may be allowed two access points, provided the location, separation, spacing and corner clearance requirements of Sections 2-04 and 2-05 are met.

2) Rural parcels shall be allowed up to two access points per parcel, provided the location, separation, spacing and corner clearance requirements of Sections 2-04 and 2-05 are met.

B. Commercial/Industrial

1) One two-way access point or two one-way access points, exclusive of alleys, shall be allowed per 500 feet of total property frontage.

2) Commercial or industrial developments located adjacent to two or more roadways may be allowed more than one access point per 500 feet, provided the corner clearance requirements of EDDS Section 2-05 are met. Access point spacing shall comply with EDDS Section 2-04 and Standard Drawing 2-050.

C. Additional Access Points

1) Additional access points may be approved by the Engineer upon submittal of a circulation plan that shows additional access points are required for traffic flow and that adjacent roads will not be adversely affected.

2) Additional access points may be required by the Engineer to provide adequate road and pedestrian circulation or emergency vehicle access. The Fire Marshal shall determine emergency vehicle access requirements pursuant to Chapter 30.53A SCC and the Uniform Fire Code.

3) A development that will generate or attract a large traffic volume may be required to consolidate traffic at specific access points. Signalization may be required where warranted by the MUTCD. Additional specifications are provided in Chapter 7 (Street Illumination, Channelization and Signals) of these Standards.

2-03 ACCESS POINT TYPES AND SPECIFICATIONS

See Standard Drawings 2-010, 2-020, 2-025, 2-030, 2-035, 2-040, 2-045

A. General

1) Access point types, radii and width specifications are provided on Standard Drawing 2-010. Specifications vary according to type of property use and road frontage section.

2) Signalized access points shall be constructed as road intersections and include curb radius returns.

3) Non-signalized access points, in areas requiring vertical curb and gutter frontage improvements, shall be constructed as drop curb driveways in accordance with Standard Drawings 2-020 (Residential) or 2-025 (Commercial/Industrial).

4) Non-signalized access points, in areas where vertical curb and gutter are not required, shall be constructed as driveway approaches in accordance with Standard Drawings 2-030, 2-035, 2-040 or 2-045.

B. Width Requirements - Residential

1) Residential access points for single-family dwellings or duplex units shall have minimum/maximum widths as follows:

   - 10 feet minimum/30 feet maximum.

2) A drive aisle access serving a multi-family residential or SFDU development shall meet the following minimum/maximum two-way access widths.

   - 25 feet minimum/30 feet maximum.

   The 25-foot minimum width and minimum turning radii of 20 feet (inside radius) and 40 feet (outside radius) are required for emergency vehicle access. The access width shall be maintained for a distance of at least 30 feet from the face of curb into the property to allow completion of turning movements.

C. Width Requirement - Commercial

1) One-way commercial or industrial access points shall have minimum/maximum widths as follows:

   - Inbound traffic: 15 feet minimum/30 feet maximum.
   - Outbound traffic: 20 feet minimum/35 feet maximum.

2) Two-way commercial or industrial access points shall have minimum/maximum access widths as follows:
   - Non-arterial road access: 25 feet minimum/40 feet maximum.
   - Arterial road access: 35 feet minimum/40 feet maximum.
3) Wider commercial or industrial access point widths, where necessary to accommodate buses, trucks or other oversized vehicles, may be approved through deviation. Such access points shall be designed to meet the additional loading and turning radius requirements.

2-04 ACCESS POINT LOCATION, SEPARATION AND SPACING

See Standard Drawing 2-050

A. General

1) Access point location, separation from intersections and spacing are critical for maintaining access point and roadway traffic flow. Access design must also satisfy the on-site circulation requirements of the intended land use, consistent with safety and operational requirements.
2) Where a property has frontage on both arterial and non-arterial roads, access shall be limited to the non-arterial road unless it can be demonstrated that an arterial road access will not negatively impact traffic flow.
3) Access onto high volume roads may be denied in the interest of traffic safety or operational requirements.
4) No part of any access point, including any flare or radius, may be located within 3 feet of a fire hydrant, no-parking zone, utility pole, traffic signal installation or light standard, mailbox cluster or similar appurtenance.
5) When property frontages are narrow, such that minimum access point spacing criteria cannot be met, joint access locations at property lines may be required.

B. Residential

1) Access points that serve more than one single-family residence shall be placed directly opposite each other wherever possible for driver awareness and safety. If opposite placement is not possible, then the separation requirements of Standard Drawing 2-050 shall be met. If such spacing cannot be provided, the Engineer may require analysis to determine if left turns should be prohibited at the access points.
2) Where two or more access points serve adjacent residential property uses there shall be a minimum separation of 10 feet between the nearest edges of access points (not including flares or radii), except where the lots are part of a zero lot line development in accordance with SCC Title 30 or a joint access has been approved by the Engineer.

C. Commercial

1) Access points for commercial or industrial property uses shall be placed directly opposite each other wherever possible for driver awareness and safety. If opposite placement is not possible, then the separation requirements of Standard Drawing 2-050 shall be met. If such spacing cannot be provided, the Engineer may require analysis to determine if left turns should be prohibited at the access points.
2) Where two or more access points serve the same or adjacent commercial or industrial property uses, the minimum separation shall be as shown on Standard Drawing 2-050.

2-05 CORNER CLEARANCE FROM INTERSECTIONS

See Standard Drawing 2-060

A. Residential

Access to residential corner lots shall be located a minimum of 10 feet from the point of curvature (PC) or point of tangency (PT) of the curb line at the intersection. If no curb exists, access points shall be located not less than 35 feet from where the projected right of way lines intersect. No portion of an access will be permitted within curb returns or curb ramps.

B. Commercial

1) Commercial or industrial property uses fronting arterial and non-arterial roads shall comply with the corner clearance requirements of Standard Drawing 2-060.
2) A minimum corner clearance of 50 feet shall be provided. If the minimum corner clearance cannot be attained, the Engineer may require investigation to determine if left turns should be prohibited into or out of the access point.
3) For access points near stop or signalized intersections the Engineer may require studies to determine if stopping queues will block the access point and if left turns should be prohibited into or out of the access point.

2-06 HORIZONTAL ALIGNMENT OF ACCESS POINTS

Access points shall be aligned at 90 degrees to the adjacent road centerline or along a radial line in a cul-de-sac.

2-07 VERTICAL ALIGNMENT OF ACCESS POINTS

See Standard Drawing 2-070

A. General

1) Maximum access grades are specified in Standard Drawing 2-070.

2) Access point approach grades and configuration shall be designed and constructed to accommodate the ultimate road standard of the intersecting roadway to prevent major access point reconstruction.

3) Where an access approach will cross an existing sidewalk, the access shall be designed and constructed to match the elevation of the sidewalk where the two intersect.

4) Reverse slope driveways may be allowed as long as sight distance requirements are met.

2-08 CONSTRUCTION OF ACCESS POINTS

A. General

1) When cutting through or crossing vertical curbs, gutters and sidewalks, access approaches must extend from the curb to back of sidewalk and be of portland cement concrete.

2) When an opening for an access or for any other purpose is to be constructed through an existing portland cement concrete vertical curb, the existing curb, or curb and gutter shall be saw cut at the limits of work or removed to the nearest construction joint. The opening shall be reconstructed in accordance with the approved plan and these Standards.

3) Prior to commencing removal or relocation of any public utilities, structures, trees, or plantings for access point construction, the applicant/developer must obtain appropriate approval(s) from the person or entity having ownership or control of such facilities or features.

2-09 SIGHT DISTANCE

For determination of sight distance at access points, see Chapter 3 of these Standards.

CHAPTER 2 DRAWING INDEX

CHAPTER 3
ROAD DESIGN

3-01 ROAD CIRCULATION

A. General

Road circulation is important in road system design for the following reasons:

- Operation of the arterial road system is improved by dispersing local traffic onto multiple roads and access points;
- Response time for emergency services is reduced;
- Time and mileage traveled by individuals and service providers, including school bus transportation, mail delivery, utilities, etc. is reduced; and
- Use of transit systems, and pedestrian and bicycle facilities, is promoted.

B. Layout and Design

The following criteria for road circulation shall be used in the layout and design of new road systems:

1) Road systems internal to developments shall be designed to promote the convenient circulation of traffic without reliance on the arterial road system. Circulation shall be provided in a manner, where possible, that will allow subsequent developments to meet these standards.

2) Internal road systems may consist of public or private roads or access ways with standards described in this chapter. Code requirements for roads and access are contained in Chapter 30.24 SCC.

3) Road systems shall be designed with intersecting roads so that the maximum distance between intersections (measured from centerline to centerline), or between an intersection and a road end, does not exceed 800 feet in urban areas or 1320 feet in rural areas.

4) Road stubs shall be constructed to the boundary of adjacent parcels to create an interconnected road system, unless topography, critical areas or other factors make road construction impractical. A road stub proposal shall include information to demonstrate that the off-site road connection is constructible. That is, the location is such that an off-site road connection could be made that would avoid sensitive areas or topographical constraints, and be a feasible road location for adjacent land development.

5) A road serving more than 250 ADT shall be connected in at least two locations with another road or roads that meet the applicable standard(s) for the resulting traffic volume.

6) Block lengths in urban areas shall be between 125 feet and 800 feet. The roads defining a block shall comply with the minimum centerline offset standards of Section 3-09. Access points within a block shall comply with the separation and corner clearance requirements of Sections 2-04 and 2-05.

7) A road connection shall be made to any road stub on an adjacent parcel that has been constructed to the shared boundary. This requirement may be waived by deviation where it can be shown that topography, critical areas or other factors make the connection impractical. However, a road connection shall be provided elsewhere to achieve the 800-foot (urban)/1320-foot (rural) road length criteria in Section 3-01.B.2 above.

8) Where a road stub on an adjacent parcel has been established by right-of-way or easement, but is not yet constructed to the shared boundary, then the road connection shall be constructed to meet the existing road on the adjacent parcel. This requirement may be waived by deviation where it can be shown that topography, critical areas or other factors make the connection impractical. However, a road connection shall be provided elsewhere to achieve the 800-foot (urban)/1320-foot (rural) criteria above.

9) The Engineer may determine that a non-motorized connection (shared use path or bikeway) between developments is appropriate in place of a roadway, through the deviation process.

3-02 ROAD CLASSIFICATION

Roads maintained by Snohomish County are classified for funding purposes using the Federal Functional Classification system. A list of road classifications is available from Public Works.

A. Arterial Classifications

The Snohomish County Arterial Circulation map contained in the Transportation Element of the Comprehensive Plan classifies County arterials into the following three categories. Refer to Section 3-04 for design criteria.

1) Principal Arterial

   Principal arterials provide for movement across and between large subareas of the County and serve predominately "through trips" with minimum direct service to abutting land uses.

2) Minor Arterial (Urban) / Major Collector (Rural)

   Minor arterials provide for movement within the large subareas of the County. They may serve secondary traffic generators and traffic from neighborhood to neighborhood within a larger community.

3) Collector Arterial (Urban) / Minor Collector (Rural)

   Collector arterials provide for movement within the smaller subareas of the County and from "higher" arterials to non-arterial roads. They may also serve neighborhood traffic generators.

B. Non-Arterial Classifications

Non-arterial roads, providing for movement to and from abutting land uses, have historically been classified as collectors, subcollectors and access roads. These roads distribute traffic from the high-volume arterial system to individual lots using the following hierarchy of road types based on purpose and typical traffic volume. Refer to Section 3-04 for design criteria for non-arterial roads.

1) Collector (Rural and Urban)

   Collectors promote the flow of vehicles, bicycles and pedestrians from arterial roads to lower-order roads. Secondary functions are to serve abutting land uses and accommodate public transit. Typical traffic volumes are usually greater than 2000 ADT and may exceed 10,000 ADT in some jurisdictions.

2) Subcollector (Rural) / Residential (Urban)

   Subcollectors and Residentials convey traffic to collectors. Residentials provide primary pedestrian and bicycle circulation within a neighborhood to residential lots and may carry some through traffic. Typical traffic volumes are usually less than 2000 ADT.

3) Local Access Road (Rural and Urban)

   Local access roads are designed to convey vehicles, pedestrians and bicycles between individual land parcels and higher-order roads. Local access roads do not carry through traffic. Traffic volumes of 250 ADT or less are typical.

3-03 RIGHT-OF-WAY WIDTH

A. Standards

Standard right-of-way widths for road classifications are specified in SCC 30.66B.520 and shown in Table 3-1. These right-of-way widths shall apply for road design, except where these Standards specify other right-of-way requirements.

Any new road to be constructed as part of a land development proposal shall be classified in the development proposal and designed with a right-of-way width conforming to the standards below, unless otherwise approved.

Where right-of-way is to be deeded or dedicated from a parcel under development, the right-of-way shall be a uniform width across the parcel and not tapered. Exceptions to this requirement may be allowed where off-site right-of-way is to be acquired for a clear sight triangle (refer to Section 3-08.E).

Table 3-1 Standard Right-of-Way Widths

STANDARD RIGHT-OF-WAY WIDTHS		
Principal Arterial	Urban	100 feet
Principal or Minor Arterial	Rural	100 feet
Minor Arterial	Urban	80 feet
Major Collector	Rural	80 feet
Collector Arterial	Urban	70 feet
Minor Collector	Rural	70 feet
Collector Road	Urban or Rural	60 feet
Subcollector & Access Road	Rural	60 feet
Subcollector & Access Road *	Urban	50 feet

* Urban access roads are labeled "residentials" by Snohomish County Tomorrow.

B. Right-of-Way Width Evaluation

Wider or narrower right-of-way widths than the standard may be required as determined by the Engineer based on criteria contained in SCC 30.66B.520(2). Right-of-way width must accommodate the road section applicable for the particular road classification, as described further in this chapter. Any change to the applicable road section must be approved by deviation.

C. Separate Tracts

Under certain circumstances, it may be desirable to reduce right-of-way width and locate facilities, such as sidewalks, walkways or trails, in separate tracts of land outside the right-of-way. Such tracts shall be owned and maintained by a homeowners association and guaranteed by covenants recorded with the plat. The recorded covenants shall be referenced on the approved final plat document.

3-04 PUBLIC ROAD STANDARDS: ARTERIALS AND NON-ARTERIALS

See Standard Drawings 3-010, 3-020, 3-030A & B, 3-040, 3-050, 3-060 and 3-065

A. General

Detailed road standards for arterial and non-arterial roads are provided in the referenced standard drawings. The standard road surfacing material is hot mix asphalt (HMA).

The number of lanes to be constructed for a particular road section shall be determined from the Transportation Element of the Comprehensive Plan and the Transportation Needs Report.

In urban areas where planter strips and sidewalks are required, there shall be a minimum of 1.5 feet of public right-of-way between the back of the public sidewalk and the private property line along arterial roads and 1.0 feet along non-arterial roads. Refer to Standard Drawings 3-020 and 3-050.

B. Concrete Road Standards

Portland cement concrete (PCC) may be used for road surfacing under circumstances described below. Design details, such as concrete reinforcement, joints, etc., shall be in accordance with the WSDOT Standard Specifications.

- Non-Arterials: Collector roads shall have a minimum depth of 8 inches of concrete over a 6-inch compacted subgrade. All other non-arterials shall have 7 inches of concrete over a 6-inch compacted subgrade.
- Arterials: A concrete design proposal for an arterial road shall be submitted to the County Engineer for approval.

3-05 PRIVATE ROADS AND ACCESS WAYS

See Standard Drawings 3-060, 3-070, 3-075, 3-080, 3-100 and 3-102

A. Private Roads

A private road is a road, privately owned and maintained, located in a tract or easement. Private roads may be utilized for access in accordance with SCC Title 30. Private roads do not include "drive aisles," the private access ways established on single lots without tracts or easements, usually in multi-family developments. Drive aisles and other private access ways are discussed further below.

Private road standards are consistent with public road standards, with one exception, since road standards should be based on function and volume, not ownership. Private roads in urban growth areas shall be designed and constructed in accordance with the applicable public road standards. Rural private (and public) roads shall be constructed per the specifications in Standard Drawing 3-060. The one exception where a difference exists between rural private and public road standards is for roads serving 90 ADT or less; refer to Standard Drawing 3-080 (Private Low-Volume Access Road (Rural)). Private road intersections shall comply with Standard Drawing 3-100.

Private roads shall be permanently established by tract or easement providing legal access to each affected lot, dwelling unit, or business and sufficient to accommodate required improvements, including provision for future use by adjacent property owners where applicable.

Each private road shall be clearly described on the face of the plat, short plat, or other development authorization and clearly signed as a private road. Private roads shall be maintained by capable and legally responsible owners, a homeowners association or other legal entity made up of all benefited property owners, in accordance with the provisions of SCC Title 30. Maintenance responsibility shall be assigned to the private owners by covenants filed with the recorded binding site plan, plat or short plat.

B. Fire Apparatus Access Roads (Fire Lanes)

A fire apparatus access road or fire lane is any road or driving surface, whether public or private, which is designed and constructed to meet the access requirements of the County Fire Code, Chapter 30.53A SCC. SCC 30.53A.512 requires that a fire lane be installed to within 150 feet of any portion of a facility or any portion of an exterior wall of the first story of a building. It also requires a minimum, unobstructed fire lane width of 20 feet, a minimum vertical clearance of 13.5 feet and vehicle turnarounds under specific circumstances, among other design requirements. Consequently, the layout and design of a development's internal road or access way system to meet fire lane requirements is a key design step. If conditions prevent such fire lane access, the Fire Marshal may require alternative fire protection measures, such as fire sprinkler systems. SCC 30.24.100 provides additional details on fire lane requirements for various development design options.

Design Requirements:

- Minimum width of 20 feet with no parking on either side, or;
- Minimum width of 24 feet with a parking lane on one side of the fire lane and a pedestrian facility meeting emergency vehicle load specifications with rolled curb on the opposite side from the parking lane; or
- Minimum width of 28 feet with a parking lane on one side of the fire lane, or;

  (Note that where a parking lane is provided on one side of the fire lane, the fire hydrants shall be located on the opposite side.)
- Minimum width of 32 feet with parking lanes on both sides of the fire lane.
- Fire lanes shall be constructed consistent with the public road pavement cross-section (pavement plus road base) for non-arterial roads. Refer to Standard Drawings 3-040 or 3-050.
- Minimum turning radii for fire lane curves and intersections shall be 20 feet (interior radius) and 40 feet (exterior radius) for emergency vehicle access.

C. Drive Aisles

A drive aisle is a private access way used in single-lot developments, such as commercial, multi-family residential or single family detached unit (SFDU) developments, where no right-of-way, tracts or easements are created for the internal road system. Drive aisles are owned in common by the property owner(s). There is no single, specific design standard for a drive aisle; the standard will be determined by its particular function, such as a fire lane, auto court, woonerf, alley, etc. Specific requirements are provided in the following subsections.

D. Alleys

An alley is a public or private access way that typically provides vehicle access to garages behind residential dwelling units or service access to the rear of buildings. Alleys may provide the primary access for a residential development if the alley meets the standards for a fire lane and if pedestrian facilities are provided separate from the alley. An alley is not considered a joint-use facility for pedestrians. Maintenance

responsibility shall be assigned to the private owners by covenants filed with the recorded binding site plan, plat or short plat.

Design Requirements:

- Design standards for residential and commercial alleys are provided in Standard Drawing 3-102.
- Connection at two points to the internal road or access way system so that neither a turnaround nor backing out of the alley is required. However, an alley may dead-end if its length is 150 feet or less.
- A minimum constructed width of 12 feet for residential uses and 16 feet for commercial uses, unless:

  (a) the alley is designated a fire lane, which must be constructed per the requirements of SCC 30.53A.512, or

  (b) garage doors open onto the alley, in which case the minimum separation between garage doors shall be 28 feet, or 24 feet between a garage door and the far side of the alley not abutting a garage door.
- Must be located entirely within a tract or easement unless the development is a commercial, multi-family residential or single family detached unit (SFDU) development on one lot. The minimum tract or easement width shall be 16 feet for residential developments or 20 feet for commercial developments as shown in Standard Drawing 3-102.
- Parking is not permitted in an alley.

E. Auto Courts

An auto court is an access way designed to be shared by vehicles, pedestrians, and bicycles within the same circulation space. An auto court is not a through facility; it ends in a "court" or courtyard area used for garage access and other activities of the residents. Maintenance responsibility shall be assigned to the private owners by covenants filed with the recorded binding site plan, plat or short plat.

Design Requirements:

- Surfacing with stamped asphalt, paving blocks, bricks or other ornamental paving materials to show that the auto court is not a standard asphalt roadway, to encourage slow vehicle speeds and to clearly indicate that the entire surface is intended for pedestrians as well as vehicles. Traffic-calming measures may also be incorporated into the design to encourage joint use.
- Maximum length of 150 feet, measured from the edge of pavement of the intersecting road or access way, unless the auto court is designated as a fire lane and constructed to the requirements of SCC 30.53A.512 and SCC 30.24.100.
- Minimum constructed width of 12 feet unless:

  (a) the auto court is designated as a fire lane, in which case it shall be constructed to the requirements of SCC 30.53A.512 and SCC 30.24.100. A rolled curb and raised sidewalk may be included as part of the minimum

20-foot fire lane width, provided that the curb and sidewalk meet emergency vehicle load rating requirements; or

(b) garage doors open onto the auto court, in which case the surfacing shall be widened to provide a minimum 28-foot separation between opposing garage doors, or a minimum of 24 feet between a garage door and the far side of the driving surface not abutting a garage door.

- The "court" at the end of the auto court shall be sized to provide a minimum 24-foot backup distance from the end of any garage, driveway apron or parking area.
- The auto court shall be located entirely within a tract or easement unless the development is a commercial, multi-family residential or SFDU development on one lot. The dimensions of the tract or easement will depend on the criteria above, but the width shall not be less than 15 feet.
- The auto court cross-section shall be an engineered design appropriate for the surfacing material and soil conditions.

F. Woonerfs

"Woonerf" is a Dutch word meaning "street for living." A woonerf is an access way designed for priority access by non-motorized users (pedestrians and bicyclists) and secondarily by motor vehicles. Commonly used in Europe, woonerfs are intended to maximize use of limited space; an example is a residential recreation area that also provides vehicle access. Residences typically front on, or very close to, the woonerf. Vehicle speeds must be kept quite low, typically a pedestrian's pace or slower, to ensure safety.

A woonerf shall connect at each end to other roads or access ways so that a turnaround is not required. Maintenance responsibility shall be assigned to the private owners by covenants filed with the recorded binding site plan, plat or short plat.

Design Requirements:

- Surfacing with materials other than asphalt to clearly indicate the entire surface is intended for primary use by pedestrians and secondary use by motor vehicles. At a minimum, both ends of a woonerf (excluding any intersecting sidewalk sections) shall be surfaced with stamped asphalt, paving blocks, bricks or other ornamental paving materials, to show the woonerf is not a standard roadway. These end sections shall extend the full width of the woonerf and be a minimum of 20 feet long, measured longitudinally from any intersecting right-of-way line. If no right-of-way is established, then measurement shall be from the back of any intersecting sidewalk; or, if none will be constructed, from the intersecting curb line or edge of pavement.
- The woonerf surface between the two end sections shall be concrete with a brushed finish.
- Maximum vehicle speed shall be 10 mph.
- Minimum constructed width shall be 12 feet unless:

  (a) the woonerf is designated as a fire lane, in which case it shall be constructed to the requirements of SCC 30.53A.512 and SCC 30.24.100; or

(b) garage doors open onto the woonerf, in which case the surfacing shall be widened to provide a minimum 28-foot separation between opposing garage doors, or a minimum of 24 feet between a garage door and the far side of the driving surface not abutting a garage door.

- Length shall be limited to serve a maximum of 150 ADT. This limitation shall not apply to private woonerfs that serve entirely non-residential development.
- The woonerf shall be located entirely within a tract or easement unless the development is a commercial, multi-family residential or SFDU development on one lot. The dimensions of the tract or easement will depend on the criteria above, but the width shall not be less than 15 feet.
- Any woonerf with a tangent section longer than 300 feet shall incorporate traffic-calming measures in that section, subject to approval by the Engineer.
- Recreational or playground facilities may be incorporated as part of the design.
- Illumination is required for traffic-calming measures and any obstacles that may obstruct vehicles or pedestrians.
- Designated vehicle parking areas may be included as part of a woonerf.
- The woonerf cross-section shall be an engineered design appropriate for the surfacing material and soil conditions.

G. Shared and Common Driveways

A shared driveway may serve two lots (duplex lots allowed), while a common driveway may serve up to four residential dwellings each in a single-lot development (multi-family residential or SFDU development). These driveways provide vehicle access from road and drive aisle systems to parking areas and structures, while reducing impervious surface and driveway access points. Shared driveways and common driveways shall not be combined.

Design Requirements:

1) Shared driveways shall:
    - Abut a public or private road or private access way;
    - Serve no more than two lots (may be duplex lots);
    - Have a constructed driveway width of at least 10 feet;
    - Have a minimum 15-foot-wide shared driveway access easement, including a maintenance declaration, which shall be the responsibility of the shared users, recorded with the Snohomish County Auditor; and
    - Be constructed in accordance with EDDS Section 2-03, including referenced standard drawings. The driveway section within public right-of-way shall be surfaced with asphalt or concrete.

2) Common driveways shall:

- Abut a public or private road or private access way;
- Serve no more than four residential dwelling units each on a single lot;
- Have a constructed driveway width of at least 10 feet;
- Be maintained by the common users; and
- Be constructed in accordance with EDDS Section 2-03, including referenced standard drawings. The driveway section within public right-of-way shall be surfaced with asphalt or concrete.

H. Primitive Road

A primitive road is a road within county right-of-way that meets the criteria of RCW 36.75.300: not classified as part of the county primary road system, has a gravel or earth driving surface, and an average annual daily traffic volume of one hundred or fewer vehicles. A primitive road must be identified with signs, as provided in the Manual of Uniform Traffic Control Devices, at all locations where the primitive road begins or connects to a non-primitive road. Primitive roads must be designated by the County Council.

I. Trail Access Permit Road

A trail access permit road is a road constructed within county right-of-way, where no county-maintained road exists (an "unopened" right-of-way), to provide access to a legal lot. A trail access permit must be obtained in accordance with Chapter 13.60.050 SCC.

A trail access permit road is not a public road and does not satisfy access requirements for land development. Construction standards are shown in Standard Drawings 3-070 and 3-075 for up to four lots in an urban area and eight lots in a rural area. Above these thresholds, a trail access permit road shall be constructed to the minimum public road standard.

A trail access permit road must meet the requirements of Chapters 30.63A (Drainage) and 30.63B SCC (Grading). Road maintenance is the responsibility of the permit holder. Where less than the required right-of-way exists, additional right-of-way shall be dedicated or deeded unless otherwise approved by the County.

3-06 HORIZONTAL ALIGNMENT

See Standard Drawing 3-105

A. Design Speed

Design speed is a speed selected to determine the various geometric design features of a roadway. Design speed shall be used to determine stopping sight distance (SSD) and intersection sight distance (ISD) requirements for new road facilities. Refer to Section 3-08 for a full discussion of sight distance analysis.

1) Arterial Design Speed

   Arterial roads are typically constructed as county road projects approved by the County Council through the Annual Construction Program for Transportation (ACP). The design speed for an arterial is established during the project design process.

2) Non-Arterial Design Speed

   a) The following design speeds shall be used for the design of non-arterial roads, public or private:

Table 3-2 Design Speed for Non-Arterial Roads

DESIGN SPEED FOR NON-ARTERIAL ROADS		
	URBAN	**RURAL**
COLLECTOR	30 mph [1]	30 mph
RESIDENTIAL / SUBCOLLECTOR	25 mph [2]	25 mph [2]
LOCAL ACCESS	25 [2] mph	25 mph [2]

1 May be reduced to 25 mph (urban) with approval by the Engineer. Refer to Standard Drawings 3-060 and 3-065.

2 May be reduced to 20 mph on a cul-de-sac road with no tangent longer than 250 feet or for other circumstances approved by the Engineer.

B. Operating Speed

Operating speed is the observed speed of vehicles during free-flow conditions. Operating speed shall be the 85th percentile speed of a roadway as determined by Public Works' recorded data. As an alternative, the appropriate modifier from Table 3-3 may be added to the posted speed to approximate the 85th percentile speed.

Where circumstances create a safety concern, the Engineer may direct that a speed study be performed to determine the 85th percentile speed.

Operating speed shall be used on existing roads to determine:

- Stopping sight distance (SSD) requirements, and
- Intersection sight distance (ISD) requirements - where the traffic volume on the minor road is less than 80 ADT.

Table 3-3 Modifiers to Determine Operating Speed

MODIFIERS TO DETERMINE OPERATING SPEED	
POSTED SPEED	**MODIFIER**
20 MPH	0 MPH
25 MPH	0 MPH
30 MPH	+ 5 MPH
35 MPH	+ 8 MPH
40 MPH	+ 10 MPH
45 MPH and ABOVE	+10 MPH

C. Horizontal Curve Radii and Superelevation

Table 3-4 contains the minimum horizontal curve design criteria, including superelevation, for low speed curves (design speed of 40 mph or less).

Table 3-4 Horizontal Curves Minimum Radii and Superelevation

DESIGN HORIZONTAL CURVES (LOW SPEED) MINIMUM RADII AND SUPERELEVATION					
		MINIMUM RADIUS (FEET) FOR			
DESIGN SPEED MPH	**MAXIMUM SUPER-ELEVATION, e**	**e =0.06**	**e =0.04**	**e =0.02**	**CROWN SECTION e =0.00**
20	n/a	n/a	n/a	n/a	90 *
25	n/a	n/a	n/a	n/av	165 *
30	0.04	n/a	230	250	275
35	0.06	320	345	375	415
40	0.06	450	490	540	600

* As an alternative, a 90 degree (+/- 10 degrees) "elbow" intersection may be constructed in accordance with Standard Drawing 3-105.

1) For design speeds above 40 mph, horizontal curve design shall comply with Chapter 6 of the WSDOT Design Manual.
2) Additional pavement width may be required on horizontal curves to provide for vehicle maneuvers where no superelevation is used and the minimum horizontal curve criteria in Table 3-4 or the WSDOT Design Manual are not met. Calculations for widening shall comply with Chapter 3 of AASHTO A Policy on Geometric Design of Highways and Streets or Chapter 6 of the WSDOT Design Manual.
3) Each horizontal curve design shall provide stopping sight distance for the design speed at all points on the road. Refer to Section 3-08 for sight distance requirements.
4) The Engineer may approve a lower design speed and centerline radius for curves in arterial roads in urban areas.
5) All roadway designs utilizing superelevation are subject to review by the Engineer. Chapter 6 of the WSDOT Design Manual should be consulted for superelevation design.
6) The maximum superelevation rates allowed for arterial roads, with design speeds of 35 mph or greater, shall be 6% in urban areas and 10% in rural areas. Superelevation is not recommended for use on non-arterials in urban areas with design speeds of less than 30 mph.
7) If reverse curves with superelevation are required in a design, then sufficient tangent length for superelevation runoff for both curves shall be provided in accordance with Chapter 6 of the WSDOT Design Manual.

3-07 VERTICAL ALIGNMENT

See Standard Drawings 3-110, 3-120

A. Grades

Road grades shall be 0.5% or greater to provide proper drainage. The maximum grade on any new or reconstructed road shall not exceed the limits in Table 3-5. Existing private roads with grades up to 15% may be used for access, regardless of the existing traffic volume or ultimate potential traffic volume on the road. New on-site or off-site private roads, and private cul-de-sac bulbs, shall meet the grade specifications of Table 3-5.

Grade transitions shall be constructed as vertical curves except at new intersections where the difference in grade is one percent or less. Refer to Section 3-09.B for additional grade at intersection requirements.

Table 3-5 Maximum Grades

MAXIMUM ROAD GRADES		
ARTERIAL		10%
NON-ARTERIAL:	COLLECTOR	10%
	RESIDENTIAL/SUBCOLLECTOR	12%
	LOCAL ACCESS	15%
CUL-DE-SAC BULB		6%

B. Vertical Curves

Vertical curves shall meet or exceed the criteria in Standard Drawing 3-110 for crest vertical curves and Standard Drawing 3-120 for sag vertical curves, to ensure that minimum stopping sight distance is provided. Sight distance is discussed in detail in Section 3-08.

For new arterial roads in rural areas, passing sight distance shall be evaluated in accordance with Chapter 6 of the WSDOT Design Manual.

3-08 SIGHT DISTANCE

See Standard Drawings 3-130, 3-140

A. General

1) Sight distance criteria established in this section are based upon A Policy on Geometric Design of Highways and Streets, AASHTO, 2001 edition.
2) Each new intersection or access point connection must meet the Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD) requirements set forth in Sections 3-08.B and 3-08.D, respectively, of this chapter.
3) Sight distance requirements in this section are based on passenger car operation and do not account for heavy vehicle operating characteristics. Access points or intersections that will handle significant numbers of heavy vehicles or trucks, as determined by the Engineer, shall be designed in accordance with Chapter 9 of AASHTO.

B. Stopping Sight Distance

Stopping Sight Distance (SSD) is the distance needed for a vehicle traveling at or near design speed to stop before reaching a stationary object in its path. The provision of stopping sight distance at all locations along each highway or street, including intersection approaches, is fundamental to intersection operation. [AASHTO, 2001]

1) SSD requirements as tabulated in Table 3-6 shall be the minimum acceptable values for designing new vertical and horizontal road alignments and evaluating the adequacy of existing vertical and horizontal alignments.

   i. Design speed shall be used to determine SSD requirements for new facilities. Refer to Section 3-06.A.

   ii. Operating speed shall be used to determine SSD for existing facilities. Refer to Section 3-06.B.

Table 3-6 Stopping Sight Distance

STOPPING SIGHT DISTANCE (SSD)	
SPEED (MPH)	**DISTANCE, "D" (FEET)**
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495

Adapted from Exhibit 3-1, A Policy on Geometric Design of Highways and Streets, AASHTO (2001).

2) In measuring SSD, the height of the driver's eyes is assumed to be 3.5 feet and the height of the object to be seen by the driver is 1.5 feet above the pavement. The driver's line-of-sight may not fall within the limits of the road; for example, on a horizontal curve the sight line will be a chord of the curve. SSD is measured along the centerline of the vehicle's travel lane, as shown in Standard Drawing 3-130.

C. Effect of Grade on Stopping Sight Distance

The stopping sight distances of Table 3-6 are based on flat road grades. For downgrades or upgrades of 3 percent or greater, SSD requirements are shown in Table 3-7. Grades other than those shown in the table may require interpolation.

Table 3-7 Stopping Sight Distance on Grades

STOPPING SIGHT DISTANCE ON GRADES							
SSD (FEET) FOR DOWNGRADE				**SSD (FEET) FOR UPGRADE**			
SPEED* (MPH)	**3%**	**6%**	**9%**	**SPEED* (MPH)**	**3%**	**6%**	**9%**
20	116	120	126	20	109	107	104
25	158	165	173	25	147	143	140
30	205	215	227	30	200	184	179
35	257	271	287	35	237	229	222
40	315	333	354	40	289	278	269
45	378	400	427	45	344	331	320
50	446	474	507	50	405	388	375
55	520	553	593	55	469	450	433

*Design speed for new facilities. Operating speed for existing facilities.

Adapted from Exhibit 3-2, A Policy on Geometric Design of Highways and Streets, AASHTO (2001).

D. Intersection Sight Distance

Intersection Sight Distance (ISD) is the distance necessary for the driver of a vehicle stopped at an intersection to decide when to enter or cross the intersecting roadway, and for the driver of a vehicle traveling at or near the posted speed on the intersecting roadway to reduce speed to avoid overtaking a vehicle that has entered the roadway.

1) Measurement

   In measuring ISD, the driver's eye location is assumed to be 15 feet from the edge of the traveled way (refer to Section 3-08.E.2). The height of the driver's eyes is assumed to be 3.5 feet and the height of the object to be seen, assumed to be another vehicle, is 3.5 feet above the pavement. "Clear sight triangles" are discussed in Standard Drawing 3-140 and Section 3-08.E.

2) Distance Requirements

The ISD requirement is determined by the type of intersection and the traffic volume:

i. Table 3-8 shall be used for low-volume, non-arterial intersections where the minor road or access point traffic volume is projected to be 80 ADT or less. This table corresponds to the stopping sight distance requirements of AASHTO.

ii. Table 3-9 shall be used when:

- the ultimate traffic volume for the proposed road or access point is projected to be more than 80 ADT, or
- the intersecting major road is an arterial.

  Exception: A private residential driveway, serving 20 ADT or less, that intersects an arterial shall use Table 3-8 instead of Table 3-9.

3) Adjustments

Circumstances may require adjustment of ISD standards:

i. For low-volume, non-arterial intersections with 80 ADT or less, use Table 3-7 instead of Table 3-8 to account for an intersecting (major) road with a downgrade or upgrade of 3% or greater.

ii. For arterial intersections or intersections serving more than 80 ADT, a driver's time gap acceptance time must be adjusted, and therefore the values of Table 3-9, when vehicles other than passenger cars will be prevalent, or where the intersecting major road has multiple lanes, or where the minor road approach has a significant grade.

Adjustment factors are provided in AASHTO Exhibit 9-54. Note that the adjustment for minor road approach grade is necessary only if the rear wheels of the design vehicle would be on an upgrade that exceeds 3 percent when the vehicle is at the stop line of the minor road approach.

If a time gap acceptance time is adjusted, then ISD must be recalculated using AASHTO Formula 9-1:

$$\mathbf{ISD = 1.47\ V_{MAJOR}\ T_S}$$

where ISD = intersection sight distance in feet, measured along the major road.

V_{MAJOR} = design speed of major road in mph.

T_S = time gap for minor road vehicle to enter major road in seconds. Refer to Exhibit 9-54.

Table 3-8 Intersection Sight Distance < 80 ADT

INTERSECTION SIGHT DISTANCE (< 80 ADT)	
SPEED * (MPH)	**DISTANCE, "D" ** (FEET)**
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495

*Design speed for new facilities; Operating speed for existing facilities.

**Table 3-7 applies if grade is 3% or greater.

Adapted from Exhibit 3-1, A Policy on Geometric Design of Highways and Streets, AASHTO (2001).

Table 3-9 Intersection Sight Distance > 80 ADT

INTERSECTION SIGHT DISTANCE (> 80 ADT)	
POSTED SPEED (MPH)	**DISTANCE, "D" (FEET)**
20	225
25	280
30	335
35	390
40	445
45	500
50	555
55	610

Adapted from Exhibit 9-55, A Policy on Geometric Design of Highways and Streets, AASHTO (2001).

E. Clear Sight Triangles

See Standard Drawing 3-140

1) At any intersection or access point connection, there must exist clear sight triangles to allow a driver stopped on an approach to depart from the minor road and enter or cross the major road.

   The "triangle" is defined by the line-of-sight from a vehicle stopped on a minor road to a vehicle approaching on the major road and back to the intersection. This area, along the intersection approach legs and across their included corners, must be clear of obstructions that might block a driver's view of potentially conflicting vehicles. Visibility applies not only to drivers on the minor road, but also drivers on the major road, allowing them to see vehicles stopped at an intersection and to prepare to slow or stop, if necessary.

2) The vertex, or decision point, of the sight triangle on the minor road or access point shall be 15 feet from the edge of the major road traveled way. The edge of the traveled way shall be the outside edge of the travel lane. Bicycle lanes, walkways or paved shoulders are not included.

3) The driver's eye location may be reduced to a minimum of 10 feet from the edge of traveled way, with approval of the Engineer, where the reduction in driver's eye location will not adversely affect safety or operation. Examples where this may be allowed include: an intersection on the outside of a horizontal curve; an intersection where one approach is in a cut or fill; or where a bridge abutment obscures the line of sight from 15 feet back but not 10 feet.

4) The line-of-sight defining one side of the clear sight triangle may cross private property and be obstructed by objects or vegetation outside the existing public right-of-way. To ensure that sight distance is maintained, the area within a clear sight triangle shall either be acquired and conveyed to the County as new public right-of-way or a sight distance easement recorded to allow maintenance of the clear sight triangle.

5) When provision of sight distance is a condition of an application approval, it shall be the applicant’s responsibility to accomplish any activities necessary to provide sight distance, such as trimming or removal of vegetation or regrading of earth.

F. Special Circumstances

If circumstances are different from those presented in these Standards, the Engineer may establish sight distance standards and requirements that generally conform with the intent of the sight distance guidelines in the latest edition of AASHTO.

G. Documentation of Sight Distance

To verify acceptable sight distance, the Engineer may require a developer to evaluate and document an existing sight distance condition. The evaluation and documentation of sight distance shall include the following, or such additional information as may be necessary to make a determination:

- Plan, profile and cross-section drawings along the sight line
- Posted speed, operating speed and/or speed study data
- Right-of-way and easement limits (existing and proposed)

When the Engineer determines from the documentation presented that a location has insufficient sight distance, a plan to improve the sight distance to meet these standards will be required.

3-09 INTERSECTIONS

A. Angle of Intersections

New road intersections shall be designed so that roads intersect at a 90-degree angle, plus or minus 5 degrees. Under no circumstances shall the angle of intersection be less than 75 degrees.

B. Grades at Intersections

Road grade transitions at intersections shall be designed using vertical curves wherever the grade change exceeds 1%. This includes the transition from the slope of the intersecting road to the cross-slope of the road being intersected. Vertical curve standards are provided in Standard Drawings 3-110 or 3-120.

For safety reasons, a landing or safe stopping area must be provided before the intersection. The landing may be part of the vertical curve transition between the slope of the intersecting road and the cross-slope of the road being intersected. The standard to be met for an acceptable landing is no more than one foot of elevation change for a distance of 30 feet from an arterial road or 20 feet from a non-arterial road, measured from the ultimate right-of-way line of the road being intersected.

For low-volume roads (<1000 ADT) approaching a stop sign controlled intersection, a 20 mph design speed with a minimum vertical curve length of 60 feet may be used for the final curve at the intersection. This applies to urban residential roads and rural subcollector and local access roads.

C. Radius Returns

The minimum radius returns to be installed at road intersections are specified in Table 3-10:

Table 3-10 Minimum Radius Returns

MINIMUM RADIUS RETURNS		
ROAD TYPE	**INTERSECTING ROAD**	**RADIUS RETURN**
Any Road	Arterial	35 feet
Any Non-Arterial	Collector	25-30 feet
Residential Subcollector Local Access	Residential Subcollector Local Access	20 feet

Note: Roads with truck or bus traffic may require larger radii at intersections. The WSDOT Design Manual shall be used as a guide in evaluating such designs.

D. Centerline Offsets

Minimum centerline offsets between parallel roads, on either the same or opposite sides of the primary street, are specified in Table 3-11:

Table 3-11 Minimum Centerline Offset

MINIMUM CENTERLINE OFFSET (FEET)				
		INTERSECTING ROAD TYPE		
PARALLEL ROAD TYPE*	Area	Arterial	Collector (Non-Arterial)	Residential Subcollector Local Access
Arterial	U	330	200	165
	R	330	250	165
Collector (Non-Arterial)	U	200	150	150
	R	250	150	150
Residential & Local Access	U	165	125	125
Subcollector & Local Access	R	250	125	125

Area: U = urban area, R = rural area

** Note: Where two parallel roads have different classifications, the higher classification shall be used to determine the centerline offset.*

3-10 ROAD ENDS

See Standard Drawing 3-150

A. General

A road end is the physical termination of the traveled way. Road ends, whether public or private, shall meet the following criteria, in addition to the specifications of Standard Drawing 3-150:

1) The required permanent road end for all roads longer than 150 feet is a cul-de-sac, with a minimum paved radius of 40 feet. A 30-foot radius cul-de-sac at the end of a road longer than 150 feet may be allowed with specific written approval by the Fire Marshal. Fire sprinklers are typically required in all dwellings taking access from a reduced-radius cul-de-sac.
2) Roads 150 feet or less in length may end in a road stub without a turnaround. However, if four or more access points are located within 50 feet of the road end, then a cul-de-sac with a minimum paved radius of 30 feet is required.
3) Hammerhead turnarounds are allowed as temporary road ends only, with approval of the Fire Marshal.
4) The maximum length of a road ending in a permanent road end, measured from the nearest intersection, shall be 800 feet in urban areas and 1320 feet in rural areas.
5) Pedestrian facilities shall be provided around a permanent road end if facilities exist along the road leading to the permanent road end or if pedestrian facilities should be constructed along the road as the adjacent land is developed. Pedestrian facilities are not required along roads 150 feet or less in length ending in a road stub.
6) Planter strips may be installed, but are not required, around permanent or temporary road ends.
7) The maximum slope in any direction within a cul-de-sac bulb is 6%. A temporary road end may exceed 6% with approval of the Fire Marshal.
8) The Engineer may require a road end to be designed to allow emergency vehicle access where connection to an existing road or future road is possible.
9) To provide pedestrian circulation, the Engineer may require an off-road walkway to connect a permanent road end to other roads, parks, schools, neighborhoods, bus stops, or other pedestrian destinations. Refer to EDDS Section 4-07.

B. Drop-Curb Cul-de-Sac

A drop-curb cul-de-sac is a design option that may be used where multiple driveways around a cul-de-sac bulb will reduce the functionality of vertical curbs, planter strips and sidewalks. Where five or more access points are taken around the bulb, vertical curb may be eliminated and a drop-curb (1-inch lip, see Standard Drawing 2-020) or rolled curb installed around the cul-de-sac bulb.

3-11 AUXILIARY LANES

The design of road width transition tapers, speed change lanes, left turn or right turn lanes will be evaluated on a case-by-case basis using the WSDOT Design Manual as a guide.

Refer to Standard Drawing 7-060 for channelization requirements.

3-12 HIGH OCCUPANCY VEHICLE (HOV) LANES

The design of HOV lanes on County roads will be evaluated using the WSDOT Design Manual.

3-13 TRANSIT STOPS

See Standard Drawing 3-160

A. General Requirements

Land development applications and county road projects are reviewed by local transit agencies for provision of appropriate transit facilities. Facilities may include pedestrian accessibility improvements, bus stops or pullouts, or other related facilities.

1) Bus pullouts will be required if:
    i. Traffic volume and passenger loading/unloading conditions warrant;
    ii. Traffic flow would be greatly hindered by in-lane stopping; or
    iii. The posted speed limit is 35 mph or greater.
2) Bus Pullout Locations
    i. Bus pullouts should be placed on the far side of both signalized and non-signalized intersections; immediately following the intersection is preferred. The distance between pullouts should not be less than 1000 feet.
    ii. If far-side pullouts are not possible, then near-side or mid-block pullouts will be considered.
    iii. Bus pullouts should be constructed on both sides of a two-way street in a complementary pair, if possible.

iv. The following guidelines shall be used to locate a bus pullout in relation to an existing access point or to locate an access point in relation to an existing bus pullout:

- A minimum separation of 105 feet, with 125 feet preferred, shall be provided between the pullout and an access point on arterial roadways. The requirement is 55 feet, with 75 feet preferred, on non-arterial roadways. This distance is measured from the edge of the access point to the front or back of the transit vehicle, whichever end is closer.
- Driveways shall not be located within the limits of a bus pullout.

3) Bus Pullout Design

i. Bus pullouts shall be designed as depicted in Standard Drawing 3-160. All bus pullouts and related facilities must comply with applicable guidelines of the Americans with Disabilities Act.

ii. A landing pad, at least 9 feet wide and 15 feet long, shall be constructed at bus pullouts, or where requested by a transit agency or school district, for passenger waiting and wheelchair access.

3-14 PEDESTRIAN CIRCULATION

See Standard Drawings 3-010, 3-020, 3-040, 3-050, 3-060 and 3-065

Pedestrian facilities, such as sidewalks, walkways and trails, provide a transportation alternative to motor vehicles. Pedestrian circulation is made possible by connection of facilities constructed by the County or by private developers as a condition of land development permits.

The pedestrian facilities appropriate for a location are determined by the following, as applicable:

- location of the project - urban or rural
- location of facilities - on-site or off-site
- classification of adjacent road(s)
- RCW 58.17.060 or 58.17.110 for off-site facilities
- Chapter 30.66B SCC and Public Works' Policy 4205 "Frontage Improvements"
- Snohomish County Transportation Needs Report (TNR)

Design standard options for pedestrian facilities are listed below and followed by Table 3-12, describing where they may be used. The goal is to provide safe pedestrian facilities that will encourage their use. Project developers are encouraged to contact Public Works prior to design to determine the appropriate facility standard.

A. Pedestrian Facility Options

1) Sidewalk separated by curb, gutter, and planter strip (Standard Drawings 3-020, 3-050)
2) Walkway separated by ditch, gravel or planter strip (Standard Drawings 3-010, 3-040)
3) Raised walkway separated by extruded curb
4) At-grade paved shoulder adjacent to traveled way (Standard Drawings 3-010)

Table 3-12 Pedestrian Facility Standards

PEDESTRIAN FACILITY STANDARDS				
AREA	**FACILITY LOCATION**	**INTERIM OR ULTIMATE**	**STANDARD OR OPTION**	**SPECIAL PROVISIONS**
Urban	On-site	Ultimate	1)	
Urban	Off-site	Ultimate	1)	
Urban	Off-site	Interim	2)	Minimum width and separation 5 feet.
Urban	Off-site	Interim	3)	Use where right-of-way is limited. Illumination required. Adjacent travel lane 13 feet wide.
Urban	Off-site	Interim	4)	Non-arterials only with posted speed 30 mph or less.
Rural	On-site	Ultimate	2)	
Rural	On-site	Interim	2)	

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CHAPTER 3 DRAWING INDEX

CHAPTER 4

ROAD ELEMENTS AND FEATURES

4-01 LANDSCAPING

See Standard Drawings 4-010 through 4-120

Landscaping in the county road right-of-way provides numerous aesthetic, environmental and safety benefits. The County's landscaping requirements are codified in Chapter 30.25 SCC. The following specifications provide amplifying information for the landscaping of county roads and stormwater facilities, with additional details contained in the Snohomish County Roadway Landscaping Standards (RLS).

A. Planter Strips

A planter strip is that portion of the right-of-way between the curb line and the sidewalk or between the sidewalk and the right-of-way line used for the planting of trees, shrubs, groundcover or grass. Planter strips are required, as shown in Standard Drawings 3-020 and 3-050, along urban arterial and non-arterial roads, except where the roads serve 90 ADT or less and there is no potential for connectivity, or where a critical area or its buffer borders a county right-of-way or a private road easement. Planter strips may be installed, but are not required, around permanent or temporary road ends. The design of planter strips must be approved by the Engineer through a landscaping plan in which plant maintenance, utilities and traffic safety requirements are addressed.

The preferred planter strip location is between the vertical curb and sidewalk to enhance the urban road appearance. However, planter strips may be located behind sidewalks or on both sides of sidewalks, as discussed further below, if approved by the Engineer, sufficient right-of-way is available and the landscape design will fit with the surroundings. For arterial roads, a minimum 5-foot separation must be provided between the vehicle travel lanes and the sidewalk. Options include the planter strip or construction of a bicycle lane, provided the road is designated as a bicycle route.

B. Planting Types

Landscape plantings, approved for use in public right-of-way, are grouped into four categories described below. Height, spacing, and plant root development have been evaluated to prevent interference with overhead or underground utilities. Approved species for each category are listed in Standard Drawings 4-010 through 4-040. Tree and shrub size specifications at time of planting are contained in SCC 30.25.015.

Due to the sensitive nature of critical areas, as defined by Chapter 30.91C SCC, no non-native species may be planted for landscaping in a public right-of-way that borders a critical area.

1) Small Trees (25 to 35 feet high +/-)

   Suitable for use under overhead utility wires. May be used in planter strips in front of or behind sidewalks.

   - Average tree spacing: 25 feet to 30 feet, on center.

2) Medium Trees (30 to 50 feet high +/-)

   Not for use under overhead utility wires. May be used in planter strips in front of sidewalks where utilities are located underground. Refer to Standard Drawings 4-050 and 4-060.

   - Average tree spacing: 35 feet to 40 feet, on center.

3) Large Trees (50 feet high or larger)

   Not for use under overhead utility wires. Use only behind sidewalks or where large planter strips, 8 to 10 feet wide, are planned. Conifers may be placed only behind sidewalks. Refer to Standard Drawing 4-060.

   - Average tree spacing: 35 feet to 40 feet, on center.

4) Shrubs and Groundcovers

   Suitable for use in a narrow planter (2 to 5 feet wide) in front of a sidewalk, where trees are planted behind the sidewalk, or interspersed between trees in planters either in front of or behind sidewalks. Refer to Standard Drawing 4-070.

   Refer to Standard Drawing 4-080 for small shrub/groundcover spacing. Drawings 4-090, 4-100 and 4-110 illustrate planter strip design using trees and lawn; trees and groundcover; and trees, shrubs and groundcover, respectively.

C. Tree Planting and Maintenance

1) Tree and shrub size specifications at time of planting shall comply with SCC 30.25.015.
2) Trees shall be planted so that the center of each trunk is 3 feet from the back of curb or, if planted behind a sidewalk, 3 feet from the back of sidewalk. Refer to Standard Drawings 4-050, 4-060 or 4-070.
3) Where trees are to be planted adjacent to a sidewalk, a root barrier shall be installed on the sidewalk side of each tree, parallel to and 6 inches from the sidewalk. The barrier shall be 15 feet long, centered horizontally on the tree trunk and extend from the ground surface to a depth of 18 inches.
4) Standard Drawing 4-120 shows measures to be taken for removal of compacted structural fill and replacement of material to promote tree survival.
5) Trees shall be trimmed so that no branches extend below 14 feet above a traffic lane, or 7 feet above a bicycle lane or pedestrian facility.

D. Stormwater Facility Landscaping

Stormwater detention facilities shall be landscaped with vegetative buffers/screens pursuant to SCC 30.25.023. An approved planting list is provided in Appendix B.

Fencing around the facilities may be required for safety and security as discussed in Section 5-11.C.6 of these Standards. Chain link fence is specified. As an option to improve the visual appearance of the facility, vinyl-coated fencing in a dark, natural color may be installed in addition to the landscaping.

4-02 MEDIANS

A. General

1) Where landscape planters or medians are required for traffic control, these features shall be added to the width of the appropriate road standard specified in Chapter 3.
2) Medians and planters shall be designed so that neither sight distance nor vehicle turning radii are limited.
3) Medians may be covered with grass, landscape plantings, aggregate, asphalt or concrete.
4) Borders shall be defined by curbs as specified in Section 4-03, or by shoulders and ditches. Where shoulders are provided in lieu of curbs, they shall be a minimum of 5 feet in width.
5) Median design shall be reviewed for pedestrian accessibility based on the WSDOT Design Manual and ADA criteria.
6) Medians and landscape planters shall be illuminated, as determined by the Engineer. Refer to Chapter 7 of these Standards.

4-03 SURVEY MONUMENTS AND CORNERS

See Standard Drawing 4-130

A. General

1) In accordance with Chapter 332-120 Washington Administrative Code (WAC), no survey monument as defined therein shall be removed or destroyed without first obtaining a permit from the Department of Natural Resources. Any party causing the removal or destruction of a survey monument shall be responsible for ensuring that the original survey point is perpetuated.
2) All existing survey control monuments that are disturbed, lost, or destroyed during surveying or construction shall be replaced, at the expense of the responsible party, by a land surveyor registered in the State of Washington.
3) Survey monuments shall be installed in all subdivisions and short subdivisions where required by SCC Title 30. Specifications for roadway monuments are provided in Standard Drawing 4-130.
4) Boundaries of final plats, short plats and binding site plans shall be established with standard steel reinforcing bars or steel pipes permanently marked with the land surveyor's registration number. The same corners shall be used to mark the subdivision lot, tract and NGPA easement boundaries. Boundary lines or corners that are section or quarter-section corners shall be marked with standard monuments. Refer to Standard Drawing 4-130.

5) If a property corner is occupied by a fence post, an offset standard steel reinforcing bar shall be installed along one of the boundary lines. Offset concrete monuments shall only be set to witness section and quarter-section corners.

6) Standard steel reinforcing bars shall be 24 inches in length and at least 1/2 inch in diameter; steel pipes shall be at least 3/4 inch inside diameter. Pipe or rebar shall be permanently tagged with the land surveyor's registration number.

7) A monument shall be installed at each intersection of a new plat road centerline with the centerline of an existing county road right-of-way. Monuments at intersections with state highways are subject to the requirements and approval of the Washington State Department of Transportation.

8) Each monument, case and cover shall be set in accordance with Standard Drawing 4-130, for all PC, PT, center of cul-de-sac and road centerline intersection points. The point of intersection (PI) will be acceptable in lieu of a PC and PT for plat road curves, provided the PI falls within the paved roadway and approval is granted by the Engineer.

9) If monuments have not been set prior to recording of a plat or short plat, then a signed and sealed Certificate of Monumentation shall be submitted by the developer's land surveyor prior to construction acceptance of all land subdivision activities and/or road improvements requiring monumentation.

10) Where an existing monument is on the same tangent line, visible and within 250 feet of the nearest plat boundary line projected to the centerline of a county road right-of-way, only one monument is required. However, a backsight monument must be on the same tangent and visible at a distance of not less than 250 feet from a controlling monument. The distance tie between the existing monument and the intersection shall be shown on all plat or short plat drawings and the final plat or short plat.

4-04 CURB DETAILS

See Standard Drawings 4-140, 4-145

A. Vertical Curb and Gutter

Vertical curbs and gutters are preferred for all curbed roadways and are required on urban arterial roads. Refer to Standard Drawing 4-140.

B. Other

1) Cement Concrete Barrier Curb

   Cement concrete barrier curb shall be used for edges of islands and medians in urban areas, except where emergency vehicle access across the median is required. Refer to WSDOT Standard Plan F-1.

2) Thickened Edge

   An asphalt thickened edge may be used on rural non-arterial roads to control drainage. The Engineer must approve use on arterial roads. Refer to Standard Drawing 4-145.

3) Extruded Curb

Extruded asphalt or concrete curb may be used for parking areas that will not become part of the county road system. Refer to Standard Drawing 4-145.

4) Rolled Curb and Gutter

Rolled curb and gutter may be installed in the following locations:

- Infill parcels with rolled curbs on both sides.
- Drop-curb cul-de-sacs (refer to Section 3-10.B).
- Lynnwood UGA on non-arterial residential roads.
- Mill Creek UGA on non-arterial residential roads that are not adjacent to public facilities, such as parks or landscaped islands.
- Where the parcels adjacent to a development, on the same side of the county right-of-way, have rolled curbs installed or approved for installation by the Engineer.
- Other urban areas, provided that additional measures, such as planting of trees or shrubs in a planter strip adjacent to the curb, are taken to discourage parking on the rolled curb. Refer to Standard Drawing 4-140.
- On the internal roads of rural developments where the road drainage system is designed to handle runoff appropriately.

4-05 CONCRETE SIDEWALKS

See Standard Drawings 4-150

A. General

1) Sidewalk cross slopes shall not exceed 2 percent.
2) Sidewalks located along a road shall follow the road grade in most cases. Where a sidewalk is separated from a road, its grade may or may not be controlled by the road grade. If not, the sidewalk grade shall not exceed 8.33% (1 foot vertical in 12 feet horizontal).
3) Subgrade compaction requirements shall comply with the Standard Specifications published by WSDOT.
4) In urban residential areas, concrete sidewalks shall be provided on both sides of roads and around cul-de-sac perimeters unless specified otherwise by these Standards.
5) In urban commercial/industrial areas, concrete sidewalks shall be provided on both sides of roads, except internal private roads, and around cul-de-sac perimeters. This requirement may be waived by deviation if it can be demonstrated that the proposed business or industry will not generate pedestrian traffic and that continuity of pedestrian facilities is not required.
6) In cut areas, a drainage collection system shall be installed behind the sidewalk.

B. Width

1) Single-family residential zoned areas: 5 feet minimum.
2) Commercial/industrial and multi-family residential zoned areas: 7 feet minimum.
3) Where a sidewalk is located adjacent to a curb, the width of sidewalk is measured from the back of the curb to the back of the sidewalk.
4) If it is necessary to locate facilities, such as mailboxes, hydrants, signposts, poles, pedestals, etc. within a sidewalk, then the sidewalk shall be widened to provide a minimum horizontal clearance of 44 inches (48 inches preferred) around any part of the obstruction.
5) Meandering sidewalks, where approved by the Engineer, shall be constructed to maintain a full 5-foot width plus one foot of clearance around obstructions, including mailbox mountings that cannot be relocated. Additional right-of-way may be required to accommodate a meandering sidewalk or to relocate the obstruction behind the sidewalk.

C. Thickness

1) Sidewalk concrete thickness depends on the type of curb section, sidewalk location and whether the sidewalk is part of a driveway:
   i. Vertical curb section: 4 inches
   ii. Rolled curb section:
      - 4 inches (if planter strip between curb and sidewalk)
      - 5 inches (if sidewalk next to curb)
   iii. Driveway: 6 inches (portion of sidewalk crossed by driveway)
2) Sidewalk concrete shall meet a strength standard of 3000 psi @ 28 days.
3) Sidewalk concrete shall be reinforced per Section 9-07 of the WSDOT/APWA Standard Specifications.

D. Curb Ramps

1) Curb ramps are required to provide access between elevated pedestrian facilities and roadways. Ramps shall be installed at legal pedestrian crossings unless a crossing is prohibited and signed as a prohibited crossing. Note that RCW 47.04.010 defines "crosswalk" as the portion of the roadway between the intersection area and a prolongation or connection of the farthest sidewalk line or, in the event there are no sidewalks, then between the intersection area and a line 10 feet therefrom, except as modified by a marked crosswalk. This definition and the curb ramp requirement apply to "T" intersections as well as conventional 4-way intersections.
2) Curb ramp types are categorized by their design and position relative to the pedestrian facility and the roadway. Types and specifications are provided in WSDOT Standard Plans F-40 (series) and F-42.10-00. Additional information and details may be found in "Sidewalk Details – A Guide for Washington Local Agencies, Tribes and Nations" (WSDOT) and the Pedestrian Facilities Guidebook (WSDOT, PSRC, CRAB, AWC).

3) Diagonal curb ramps, located at the midpoint of curb radii, are not permitted in new construction sidewalks. They may be installed only when required for the modification of an existing sidewalk.

4) Curb ramps shall be aligned to fall within the boundaries of crosswalks, marked or unmarked. Pedestrians who have vision or mobility impairments shall not be directed outside the crosswalk or into a vehicle travel lane. Wherever possible, curb ramps shall be installed perpendicular to the curbs and in-line with the direction of travel at the crossings to assist pedestrians. (See "Layout 3" in WSDOT Standard Plans F-40.10 and F-42.10.) Ramps shall not be located outside the curb radius because such placement makes pedestrians less visible to turning vehicles.

5) The longitudinal slope of a curb ramp shall not exceed 1:12 or 8.3%. The counterslope from the end of the ramp to the roadway should not exceed 5%, as a slope change of more than 13% can cause wheelchairs to pitch forward. The maximum cross-slope of a curb ramp is 2%.

6) The minimum clear width of curb ramps, excluding the side flares, is 4 feet. In restricted areas or other special situations, the width may be reduced to 3 feet with a deviation approved by the Engineer.

7) A level landing, typically part of the sidewalk, shall be provided at the top of each ramp. The width shall be at least as wide as the curb ramp and the length, measured from the end of the ramp to the back of the sidewalk, shall be at least 4 feet. The cross-slope of the landing shall not exceed 2% in any direction.

8) The maximum slope of the side flares between the curb ramp and the sidewalk is 10%, measured parallel to the gutter. The maximum slope is reduced to 8.3% (1:12) if a ramp design is approved by deviation that requires a portion of the flares to be used for wheelchair maneuvering to and from the ramp. An example would be for a landing that has to be shorter than 4 feet.

9) Avoid placing a drainage low point and a catchbasin or inlet within a curb ramp or crosswalk.

10) Ramps shall not be obstructed by hydrants, signposts, poles, pedestals or other utilities, or any other obstruction.

11) If a new ramp is installed on one side of a road or intersection, then the responsible party shall install a corresponding ramp on the opposite side of the road or intersection, even if modification of an existing sidewalk is required.

12) Surface materials used for curb ramps shall be concrete or asphalt for stability and a relatively slip-resistant surface. Decorative surface materials, such as bricks or tiles, shall not be used in ramps or crosswalks because of the uneven surface they create for pedestrians.

13) Curb ramps shall include a detectable warning surface strip, measuring 2 feet in the direction of travel and the full width of the ramp (excluding side flares), near the bottom of the ramp to identify the transition between the sidewalk and the road. The warning strip should be set back 6 to 8 inches from the

bottom of the curb. The strip shall be a pattern of truncated domes as specified in the WSDOT Standard Plans referenced in (2) above.

14) Detectable warning surfaces shall contrast visually with the adjacent gutter, road or walkway surface, either light-on-dark or dark-on-light. The ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) recommend that the materials used provide a contrast of at least 70%, as defined in that document. The recommended color for contrast is "federal yellow" or "safety yellow."

15) Pedestrian signal devices at intersections shall be installed to be accessible to pedestrians with vision or mobility impairments. Signal poles shall be located to not obstruct pedestrian movements. Criteria for accessible pedestrian signals are provided in "Accessible Sidewalks and Street Crossings" published by the US Department of Transportation, Federal Highway Administration.

4-06 ASPHALT WALKWAYS

See Standard Drawings 3-010, 3-030A & B, 3-040, 3-060 and 4-160

A. General

A walkway is a pedestrian facility typically utilized in rural areas, constructed of asphalt and located either adjacent to the vehicle travel lanes or separated from the roadway. Physical separation from the travel lanes may be provided by a ditch, gravel shoulder or planter strip. The ditch-separated design, shown in Standard Drawing 3-040, is the adopted standard for rural non-arterial roads because of the enhanced pedestrian safety and rural road appearance this design provides. Where soil conditions allow, a separated walkway may utilize porous or permeable materials to facilitate infiltration of stormwater runoff.

In urban areas, the preferred standard for pedestrian facilities is a sidewalk separated from the travel lanes by gutter, curb and a planter strip. However, where the ultimate urban standard improvements have not or cannot be constructed, widened paved shoulders delineated as walkways may be approved as interim improvements along roads with posted speeds of 35 mph or less. Non-separated walkways shall not be attached to roads with posted speeds greater than 35 mph. Another option for urban areas is a raised walkway, separated by an extruded curb and illuminated, that may be installed in certain circumstances as described in Section 3-14.

Project developers are encouraged to contact Public Works prior to design to determine road standard, frontage improvement and pedestrian facility requirements.

B. Design

1) Separated walkways shall have a minimum width of 5 feet with a minimum separation of 5 feet from the outside edge of the traveled way, if delineated; otherwise, the outside edge of pavement.

2) Cross-section illustrations and design details are provided in Standard Drawings 3-010, 3-040 and 4-160.

3) At-grade, non-separated walkways shall have a minimum width of 7 feet or 8 feet, depending on road classification. Refer to Standard Drawings 3-030B, 3-040 and 3-060 for requirements.

4) Non-separated walkways shall be posted with "No Parking" signs at intervals not to exceed 300 feet.

5) Surfacing and structural section requirements are provided in text Section 4-09 and Table 4-1.

4-07 SHARED USE PATHS

A. General

1) A shared use path is a multi-use facility, physically separated from the roadway, for bicyclists, pedestrians or other non-motorized users.

2) A public access easement or tract for a shared use path may be dedicated to facilitate pedestrian circulation between neighborhoods, schools, shopping or recreation areas, trails, transit facilities or other activity centers.

B. Design

1) The minimum easement or tract width shall be 15 feet. The easement or tract shall be configured so that a clear field of view is provided from each end of the path.

2) Minimum width of the shared use path shall be 10 feet, including gravel or grass shoulder areas, for access by maintenance vehicles. At least 6 feet of width shall be surfaced as specified in Section 4-09.

3) Maximum recommended grade is 5 percent.

4) The WSDOT Design Manual provides additional design information.

5) Bollards or diverters shall be installed where required by the Engineer. Refer to Section 4-11 and Standard Drawing 4-170.

6) Appropriate signing for path and road crossings may be required by the Engineer.

4-08 BIKEWAYS

See Standard Drawings 3-010, 3-020, 3-030A and 3-040

A. General

1) Bikeways shall be designed to avoid hazardous conditions that might force awkward or unsafe bicycle movements. The design and placement of storm drainage facilities and other utilities shall be done in such a way to minimize bikeway impacts. Channelization, striping and signing shall be in accordance with the MUTCD, or as approved by the Engineer. New signalized intersections shall be equipped with video detection capability for bicycles where bicycle facilities exist or where bicycle facilities will be constructed. If video detection is not installed, then an alternate bicycle detection system is required.

2) Bicycle lanes shall be installed, on any urban arterial or non-arterial road designated a bikeway route on the "Countywide Bicycle Facility System" of the Transportation Element of the Comprehensive Plan, as part of any road construction, reconstruction or frontage improvement project.

3) Urban arterial roads that are not designated bikeway routes on the "Countywide Bicycle Facility System" shall provide exterior lanes widened to 14 feet as part of any road construction, reconstruction or frontage improvement project. These widened lanes shall serve as shared roadways as defined in the following subsection.

B. Classification

Bikeways are classified as follows:

1) Shared Use Path

   Refer to Section 4-07 of these Standards and the WSDOT Design Manual.

2) Bicycle (Bike) Lanes

   - Bike lanes are additional pavement width delineated on each side of a roadway outside the through travel lanes except at intersections.
   - Minimum width shall be 5 feet in a curb road section and 4 feet in a non-curb section.
   - On roads that allow parking, the width of combined parking lanes and bike lane shall be 12 feet.

3) Signed Shared Roadway

   A shared roadway designated by signing as a preferred route for bicycle use. Appropriate bike route signs shall be installed to indicate that improvements, such as widened shoulders, have been provided.

4) Shared Roadway

   All roadways open to both bicycle and motor vehicle traffic. Delineated bicycle facilities are not provided.

4-09.0 SURFACING REQUIREMENTS

A. Design

1. All materials and workmanship shall be in accordance with the WSDOT Standard Specifications, or as approved by the Engineer.
2. Arterial roads shall be designed in accordance with WSDOT and AASHTO methods. The structural cross-section shall take into account the load-bearing capacity of the soil, the traffic volume and load requirements of the roadway. Plans shall be accompanied by the soil and traffic analyses on which the design is based. Paved shoulders or bikeways that are part of a new arterial road section shall be constructed to the same structural section as the road.
3. When pavement is added to an existing arterial road, the structural section of the improvements shall meet one of the following criteria, whichever is greater:

a. The structural section of the "Typical Non-Arterial Road – Rural Areas" (Standard Drawing 3-040) or "Typical Non-Arterial Road – Urban Areas" (Standard Drawing 3-050), or

b. The structural section of the existing arterial road to which improvements are being made. The existing road structural section shall be determined by:

   - core samples, or
   - visual inspection by the design engineer at the time the road edge is cut for construction. Certification of the existing and constructed road sections shall be provided by the design engineer in a signed memo or statement on the project's engineering record drawings.

4. Hot mix asphalt (HMA), class ½-inch, is the preferred road surfacing material. Pavement design shall be based on a design life of 20 years with a growth factor of 4% unless otherwise specified by the Engineer. As an option, Portland cement concrete (PCC) may be used under circumstances described in Section 3-04.B.
5. All pavement markings and channelization shall comply with the guidelines of the MUTCD. Refer to Chapter 7 of these Standards.
6. Permeable or porous pavement may be used in the public right-of-way for sidewalks, walkways or other pedestrian facilities where soil conditions allow infiltration. Refer to Section 4-10 of these Standards and to the Drainage Manual.
7. The minimum surfacing requirements for specific facilities described in these Standards are:

Table 4-1 Minimum Surfacing Requirements

MINIMUM SURFACING REQUIREMENTS	
FACILITY	**SURFACING REQUIREMENTS**
ARTERIALS	Per specific WSDOT and/or AASHTO design.
NON-ARTERIALS	See Standard Drawings 3-040 & 3-050, and Section 3-04.B
SIDEWALKS Portland Cement Concrete	Vertical curb section - 4 inches Rolled curb section: adjacent to curb – 5 inches separated from curb - 4 inches Driveway cuts - 6 inches See Standard Drawing 4-150.
Permeable Pavement	Engineer-designed permeable pavement where soil conditions allow infiltration. See Section 4-10 and Standard Drawings 4-164, 4-166 and 4-168.
ASPHALT WALKWAYS (ROAD SHOULDERS)	Same as Arterials or Non-Arterials above depending on road classification. See Section 4-09.A and Standard Drawing 4-160.
SEPARATED WALKWAYS Hot Mix Asphalt (HMA)	2.5 inches HMA class 1/2-inch over 4 inches crushed surfacing top course (CSTC).
Permeable Pavement	Engineer-designed permeable pavement where soil conditions allow infiltration. See Section 4-10 and Standard Drawings 4-164, 4-166 and 4-168.
SHARED-USE PATHS Hot Mix Asphalt (HMA)	2.5 inches HMA class 1/2-inch over 4 inches CSTC.
Permeable Pavement	Engineer-designed permeable pavement where soil conditions allow infiltration. See Section 4-10 and Standard Drawings 4-164, 4-166 and 4-168.
BIKEWAYS (ROAD SHOULDERS)	Same as Arterials or Non-Arterials above depending on road classification. See Section 4-09.A.

B. Subgrade

1. Except as provided in Section 4-10 for permeable pavement, subgrades for the paved facilities listed in Table 4-1 shall be well-drained, stable, and compacted. The Engineer may require additional measures if evidence exists of an unstable subgrade. Evidence may include standing water, wetland characteristics, fine-grained or organic soils, slides or uneven settlement. If any of these characteristics are present, the soil shall be sampled and tested sufficiently to establish a pavement design that will support the proposed construction. Any deficiencies shall be fully considered including an R-value of less than 55 or a CBR of less than 20.
2. Remedial measures may include, but are not limited to, a stronger paved section, a strengthening of subgrade by adding or substituting fractured aggregate, asphalt-

treated base, geotextile, controlled density fill (CDF), improved drainage or a combination of such measures. The Engineer shall review and approve the soils test report and the resulting pavement design.

3. Crushed surfacing top course (CSTC), or the approved equivalent crushed rock, may be substituted for part of the required 3-inch ATB layer in typical road sections in the ratio of 2.5 inches of CSTC per inch of ATB (compacted depths). However, in no case shall there be less than 1 inch of ATB and 3 inches of ACP covering the CSTC or crushed rock.
4. Alternative cross-sections for arterial roads may be considered when necessary to serve an engineering purpose. Supporting documentation must be submitted and a deviation approved by the Engineer.
5. The gradation requirement for gravel borrow is specified in WSDOT Standard Specifications, section 9-03.14(1), and shown in the following Table 4-2:

Table 4-2 Gravel Borrow Specifications

GRAVEL BORROW SPECIFICATIONS	
SIEVE SIZE	**PERCENT PASSING**
4 inch square	100
2 inch square	75-100
U.S. Number 4	50-80
U.S. Number 40	30 maximum
U.S. Number 200	7 maximum
Sand Equivalent	42 minimum

4-09.5 PERMEABLE PAVEMENT

See Standard Drawings 4-164, 4-166 and 4-168

A. General

1. Permeable or porous pavement can help reduce or control stormwater runoff by combining a load-bearing, durable surface with an underlying layered structure that temporarily stores water prior to infiltration or conveyance to a controlled outlet. A thorough understanding of site soil and drainage conditions is required for project design.

   This subsection provides general information on permeable pavement systems. Subsections B and C provide guidelines and specifications for porous asphalt and porous concrete, which are the more common materials being installed. Additional specifications for pedestrian facilities, which are approved for the public right-of-way, are contained in Subsection D.

2. Permeable pavement may be installed in the public right-of-way for sidewalks, walkways and shared use paths. Permeable pavement is not authorized for public roads unless a deviation is approved by the Engineer. Permeable pavement may be used outside the public right-of-way for private facilities, such as private roads, drive aisles or access ways, driveways, parking lots, etc.
3. The types of permeable pavement materials or systems are:
    - Porous concrete: Similar to standard concrete pavement, but with reduced or eliminated fine material (sand and fines) and special admixtures incorporated (optional). Removing the fines creates a porous matrix that allows water to pass through to the aggregate base and underlying soil.
    - Porous asphalt: Similar to hot mix asphalt (HMA), but with minimal fines to allow water to pass through to the gravel base and underlying soil. Because asphalt is flexible, a base layer of large-size, crushed stone is required for structural support.
    - Permeable pavers: Pavers are either cast-in-place concrete or modular pre-cast blocks of concrete or plastic. The blocks have wide joints or openings that can be filled with permeable soil and grass or gravel to allow infiltration.
    - Grid or lattice systems: A plastic grid framework installed over an open-graded aggregate base and filled with an appropriate top course of sand, soil or gravel. Infiltration occurs through the aggregate and the plastic framework provides structural strength.
4. As an infiltration system, permeable pavement may impact facilities located beneath the pavement. Project design must account for utilities or other facilities that are installed with requirements for structural support and compaction that are not conducive for infiltration. Coordination with utilities, franchisees or other vendors early in project development is recommended to identify and resolve issues that may affect the project design.
5. Permeable pavement shall not be installed where subject to heavy vehicle loads because of its reduced structural strength, or at commercial/industrial sites where the potential for spills and groundwater contamination exists. Such sites require more extensive systems, such as spill control and water quality treatment, before runoff is allowed to infiltrate.
6. Permeable pavements shall not be installed within 100 feet of wells used to supply drinking water, or as otherwise specified by other regulatory agencies.
7. Permeable pavement systems shall be installed by contractors qualified either by previous experience (at least three permeable pavement projects within the past five years) or certification by an appropriate trade organization, such as the National Ready-Mix Concrete Association.

B. Design

1. Permeable pavement systems are infiltration systems for which the design process must be consistent with the following sections of Volume III of the Drainage Manual:
   - Section 3.3, "Infiltration Facilities for Flow Control and for Treatment"
   - Appendix III-B, "Western Washington Hydrology Model – Information, Assumptions and Computation Steps"
   - Appendix III-C, "Low Impact Development Design and Flow Modeling"
2. There shall be a minimum separation of 5 feet between the bottom of any permeable pavement system (or infiltration system or trench system) and the seasonal high-water mark, bedrock (or hardpan) or other low permeability layer. The minimum separation may be reduced to 3 feet if the groundwater mounding analysis, volumetric receptor capacity, and the design of the overflow and/or bypass structures are determined to meet the site suitability criteria specified in the Drainage Manual and to be adequate to prevent overtopping.
3. Porous concrete projects should be designed and constructed in accordance with ACI 522.1-08, "Specification for Pervious Concrete Pavement," published by the American Concrete Institute.
4. Typical pavement cross-sections for porous asphalt and porous concrete pavement are provided in Standard Drawings 4-164 and 4-166. The pavement structure typically consists of the following:
   - Surface or top course: The load-bearing surface that provides strength and structure with adequate porosity for infiltration. Inspection and maintenance are required to prevent sedimentation of the void spaces.
   - Choker course: For porous asphalt, a free-draining protective layer of small crushed rock to distribute loads evenly to the base layer and provide a uniform surface for paving. The recommended specification is ASTM C33, Grading No. 8.
   - Aggregate base or reservoir course: One or more layers of crushed rock that provide temporary storage for runoff as it infiltrates and, for porous asphalt, additional strength for the surface layer. The recommended specification is ASTM C33, Grading No. 57.
   - Separation layer: Geotextile fabric shall be installed in areas of fine-grained soil (clay or silt) to prevent upward movement of soil particles and clogging of the void spaces.
5. The maximum recommended slopes for permeable pavement systems are 5% for porous asphalt, 6% for porous concrete or grid/lattice systems, and 10% for paver systems.
6. An underdrain or overflow system may be required to convey high-volume runoff and prevent saturation of the pavement. The system shall be designed to convey runoff only when the reservoir course is full.
7. Where a permeable pavement system is installed on a grade, or where the system may create a conveyance channel for intercepted groundwater, then measures such as berms and checkdams shall be installed in the reservoir course to retard horizontal flow through the layer and promote infiltration. See Standard Drawing 4-168.

8. Where the facility grade may cause infiltrated runoff to overtop an internal berm, measures such as plastic cell separation joints shall be installed above each berm as necessary to control horizontal flow through the surface layer. See Standard Drawing 4-168.
9. Transverse control (contraction) joints shall be installed in porous concrete at 15-foot maximum intervals. The joints shall extend to a depth of 1/4 thickness of the porous concrete layer. Expansion joints shall not be used except where the pavement abuts other slabs or structures.
10. Permeable pavement may be damaged by differential settlement. Project design shall incorporate measures for lateral support along pavement edges, such as a 1-foot-wide strip of compacted gravel on each side, placement next to a concrete curb or thickened edge, or other similar measures. Additional pavement strength should be provided for areas that may be subject to unintended loads, such as motor vehicles on a pedestrian facility. This may be accomplished by a thicker pavement section or by installing conventional asphalt or concrete at appropriate locations.
11. Permeable pavements used for pedestrian facilities and accessible routes of travel must have surfaces that comply with ADA (Americans with Disabilities Act) standards. Any abrupt changes in height greater than 1/4-inch must be beveled to a slope no greater than 1:2. Height changes greater than 1/2-inch require a pavement ramp be added to transition the gap.
12. ADA-compliant pedestrian facilities must include detectable warning surfaces, typically a pattern of raised truncated domes, to distinguish pedestrian areas from vehicular areas for the visually impaired. If the surface of a permeable pavement facility is rough enough to obscure the detectable warning surface, then a section of conventional asphalt or concrete shall be installed around the warning strip to emphasize the transition.

C. Subgrade

1. Soil conditions should be analyzed by a qualified engineer for load-bearing capacity based on expected soil moisture conditions. Small private projects, such as residential driveways, do not require soil analysis.
2. For permeable pavement to infiltrate properly, the existing subgrade must not be compacted or subjected to construction equipment traffic to preserve the infiltration capability of the soil. Paver systems, however, will typically require some subgrade compaction beneath vehicle traffic areas to provide structural support for the paver blocks. Manufacturer's specifications should be followed for installation of these systems.
3. Soil that has become over-compacted or plugged with fines during construction shall be removed to a depth of at least 8 inches and replaced with free-draining soil.
4. Subgrade soil should be scarified to a minimum depth of 6 inches immediately prior to placement of the aggregate base layer.

D. Permeable Pavement Pedestrian Facilities

1. Permeable pavement is authorized in the public right-of-way for sidewalks, walkways and shared use paths. No single design is appropriate for all conditions or locations; site-specific engineering is required and may dictate

specifications different from those listed below. Geotechnical investigation may even preclude the use of permeable pavement at specific sites. Alternative proposals to the requirements of this section may be submitted to the Engineer for consideration.

2. Construction plans must be prepared and approved for projects in the public right-of-way, either associated with a private land development application or with a right-of-way use permit.

3. Porous concrete is the preferred pavement material for permeable sidewalks. Use of other permeable pavement types for public pedestrian facilities must be approved by the Engineer.

4. The following specifications apply for pedestrian facility projects in the right-of-way:

   a. Pavement thickness:

      - 6 inches minimum — driveways and facilities subject to vehicle loading.
      - 5 inches minimum — facilities not subject to vehicle loading.
      - 4 inches minimum — may be approved by the Engineer for facilities not subject to vehicle loading where the project design indicates the structure will be acceptable for its intended use.

      Vehicle loading shall be assumed for pedestrian facilities located adjacent to curbs or vehicle travel lanes, at intersections or for separated facilities that allow or require maintenance vehicle access. Pedestrian facilities separated from curbs by planter strips are not considered to be subject to vehicle loading.

   b. Runoff absorption rate: 10 inches per hour minimum. Typical rates for permeable pavement exceed 100 inches per hour.

   c. Reservoir course: 6 inches minimum of washed, crushed rock conforming to ASTM C33, Grading No. 57 (refer to WSDOT Standard Specifications 9-03.1(4)C).

   d. Choker course (porous asphalt): 2 inches minimum of washed, crushed rock conforming to ASTM C33, Grading No. 8 (refer to WSDOT Standard Specifications 9-03.1(4)C).

4-10 GUARDRAILS

Evaluation, design and installation of guardrails shall be in accordance with the WSDOT Design Manual, the AASHTO Roadside Design Guide and WSDOT/APWA Standard Plans.

4-11 BOLLARDS

See Standard Drawing 4-170

A. General

Bollards may be installed at the Engineer's discretion to deny motor vehicle access to an easement, tract, or shared use path. This may include one or more fixed bollards on each side of the traveled way and removable, locking bollards across the traveled way to allow maintenance and emergency vehicle access.

Spacing intervals shall not exceed 50 inches on center.

Bollard design shall be in accordance with Standard Drawing 4-170, WSDOT/APWA Standard Plans or other design approved by the Engineer.

Fire apparatus access roads shall not be blocked in this manner without the concurrence of the County Fire Marshal.

4-12 ROADWAY BARRICADES

See Standard Drawings 4-180 and 4-185

A. General

Temporary and permanent barricades shall conform to the MUTCD and these Standards.

1) Type I or Type II barricades are intended for use where traffic is maintained through an area under construction. They may be used singly or in groups to mark a specific hazard or in a series for channelizing traffic.
2) When a road section is closed to traffic, Type III barricades shall be erected at the points of closure. Type III barricades may extend completely across a roadway and its shoulders or from curb to curb. Where provision must be made for authorized access, Type III barricades may be provided with movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where job site access is provided through a Type III barricade, the developer/contractor shall ensure proper closure at the end of each working day.
3) Type III permanent barricades shall be installed to close arterial roadways or other through roads when hazardous to traffic. They shall also be used on lanes where tapers are not sufficiently delineated. Refer to Standard Drawing 4-185.

4) Road signs may be erected on fixed barricades. The Road Closed, Detour Arrow, and Large Arrow warning signs can be mounted effectively on or above a barricade that closes a road.

5) For night use, it is desirable to add flashing warning lights when barricades are used singly and steady-burn lights when barricades are used in a series for channelization.

4-13 MAILBOXES

See Standard Drawing 4-190

A. US Postal Service

Mailbox type and location require approval of the Postal Service (USPS). Coordination with the local postmaster, early in the project design process, is important.

USPS requires installation of cluster box units (CBU) to serve four or more addresses. Specific requirements can be obtained from the local postmaster.

B. Project Construction Plans

Construction plans shall clearly show the proposed location or relocation of mailboxes, whether single or cluster boxes.

Postmaster approval of the proposed mailbox type(s) and location(s) shall be documented as part of the construction plan approval process. Any change of mailbox type(s) or location(s) shall be re-approved by the postmaster.

C. Location and Installation

1) Where a choice of roadway locations exists, mailboxes shall be located on the lower volume roadway unless otherwise approved by the Engineer and the USPS.

2) Mailboxes shall be located so as not to impede access or sight distance visibility.

3) Mailboxes located within a roadway clear zone shall have breakaway features in accordance with WSDOT Standard Plans.

4) If it becomes necessary to remove or otherwise disturb existing mailboxes within the limits of any project, the mailboxes shall be temporarily placed in such a position that their function will not be impaired. The boxes shall be reinstalled in accordance with the approved construction plans. Any damage caused by the relocation of mailboxes shall be repaired at the expense of the responsible party.

D. Road Improvements

1) Turnouts for mail delivery vehicles shall be installed to serve cluster mailbox units located along arterial roads, or any road with a posted speed of 40 mph or above. Refer to Standard Drawing 4-190.

2) A turnaround shall be provided at the end of any non-through road along which mailboxes are located. Refer to Section 3-10 and Standard Drawing 3-150.

4-14 SIDE SLOPES

A. General

1) Side slopes along arterial and collector roads shall be constructed no steeper than 3:1 for fill slopes and 2:1 for cut slopes. Along local access and residential roads, fill slopes may be no steeper than 2:1 and cut slopes no steeper than 1-1/2:1. Steeper slopes may be approved by the Engineer upon showing that the steeper slopes, based on geotechnical and hydraulic analyses, will be stable.
2) Guardrails shall be installed where appropriate pursuant to the AASHTO Roadside Design Guide.
3) Side slopes shall be stabilized by grass sod, seeding or by other planting or surfacing materials acceptable to the Engineer. All requirements of Chapters 30.63A and 30.63B SCC shall be met prior to construction approval.
4) Slope easements adjacent to the right-of-way may be required for maintenance of cut or fill slopes.

4-15 ROADSIDE OBSTACLES

See Standard Drawings 3-010, 3-040

A. General

Roadside obstacles in the right-of-way shall be located so that adequate clear zones are provided.

1) Clear zone standards for roads with posted speeds of 35 mph or less shall be:
    i. 2 feet beyond the face of curb (urban), or
    ii. 10 feet beyond the edge of traveled way (rural).
2) Clear zone standards for roads with posted speeds greater than 35 mph shall comply with Chapter 7 of the WSDOT Design Manual.
    i. New roadside features that could present a public hazard shall be placed outside of clear zone areas unless approved by the Engineer.
    ii. Existing features located inside clear zones should be relocated unless approved by the Engineer.
    iii. Installation of poles and other aboveground appurtenances will not be permitted in sidewalks, walkways or bikeways unless approved by the Engineer. As specified in the WSDOT Design Manual, there shall be an unobstructed vertical clearance of at least 7 feet above the surface of any sidewalk or walkway and 8 feet above any bikeway.

4-16 SAFETY RAILINGS

See Standard Drawing 4-200, 4-202 and 4-204

Safety railings may be required for pedestrians and/or bicyclists along roadways, bridges or pedestrian facilities. Reference standards for design, depending on the type of facility to be constructed, include the following:

- AASHTO Standard Specifications for Highway Bridges
- International Building Code
- WSDOT Design Manual

4-17 ROCKERIES

See Standard Drawing 4-210

A. General

1) Rockeries shall be designed by a geotechnical engineer if the height will exceed six feet in a stable cut section or four feet in a fill section. Construction of rockeries requiring an engineering design shall be carried out under the periodic or full-time observation of a geotechnical professional.
2) Terracing of rockeries is subject to approval by the Engineer.
3) Where a rockery or retaining wall is proposed, all warrants for a guardrail or pedestrian safety rail shall apply.

B. Materials

1) Rock material shall be as rectangular as possible. No stone shall be used which does not extend through the wall. The quarried rock shall be hard, sound, durable and free from weathered portions, seams, cracks and other defects. The rock density shall be a minimum of 160 pounds per cubic foot, measured according to WSDOT Test Method 107 (Bulk Specific Gravity - S.S.D. basis). Additionally, rock subjected to the U.S. Army Corps of Engineers Test Method CRD-C-148 (Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol") must have less than 15 percent break down.
2) Size requirements shall conform to Table 4-3:

Table 4-3 Material Size Requirements

MATERIAL SIZE REQUIREMENTS		
SIZE	**WEIGHT (LBS)**	**DIAMETER (INCHES)**
2-MAN	200-700	18-28
3-MAN	700-2000	28-38
4-MAN	2000-4000	36-48
5-MAN	4000-6000	48-54
6-MAN	6000-8000	54-60

C. Keyway

A keyway, consisting of a shallow trench of minimum 12-inch depth, shall be constructed the full rockery length, and slightly inclined downward toward the face being protected. It shall be excavated the full rockery width and its subgrade shall be firm and acceptable to the Engineer.

D. Underdrains

A minimum four-inch perforated or slotted drain pipe shall be placed in a shallow excavated trench located along the inside edge of the keyway. The pipe shall be bedded on and surrounded by "Gravel Backfill for Drains" (WSDOT/APWA 9-03.12(4)) to a minimum height of 18 inches above bottom of pipe.

The perforated pipe shall be connected to the storm drain system or to an acceptable outfall. No drain shall discharge onto the face of a slope.

E. Rock Selection and Placement

Rock selection and placement shall be such that there will be minimum voids and, in the exposed face, no open voids over six inches across in any direction. The final course shall have a continuous appearance and be placed to minimize erosion of the backfill material. The larger rocks shall be placed at the base of the facing so that it will be stable and have a stable appearance. The longitudinal axis of each rock shall be at right angles to the face. Inclined rock faces shall slope to the back of the rockery. Each course of rocks shall be seated tightly and as evenly as possible on the course beneath. The rocks shall be placed so that no continuous joint planes are created, either horizontally or vertically. After setting each course of rock, all voids between the rocks shall be chinked on the back with quarry spalls to eliminate any void sufficient to pass a two-inch square probe.

F. Rock Filter Layers

The rock filter layer shall consist of a layer of quarry spalls, with a maximum size of four inches and a minimum size of two inches, chinked on the back of the rock facing and a minimum 12-inch thick layer of drain rock between the quarry spalls and the cut or fill slope. The drain rock shall meet WSDOT/APWA Standard Specification 9-03.12(4). The backfill material shall be placed in lifts to an elevation approximately six inches below the top of each course of rocks as they are placed, until the uppermost course is placed. Any backfill material on the bearing surface of one rock course shall be removed before setting the next course.

G. Embankments

Embankments behind rockeries, in fill sections exceeding four feet in height above the keyway, shall be reinforced with a geosynthetic fabric or geogrid specifically manufactured for soil reinforcement and designed on a project-specific basis by a qualified engineer.

H. Sidewalks Above Rockery Facings

When a sidewalk is to be built over a rock facing, the top of the facing shall be sealed and leveled with a cap constructed of cement concrete Class 3000 in accordance with the applicable provisions of Section 6-02 of the WSDOT/APWA Standard Specifications. Water content shall be reduced so that slump does not exceed two inches.

I. Fences and Handrails.

A chain link fence or metal handrail shall be installed when a rockery is 30 inches or greater in height.

4-18 MAINTENANCE - ROAD ELEMENTS AND ROADSIDE FEATURES

Project plans shall be reviewed to ensure that all road elements proposed for public maintenance will be maintainable by the County. Maintenance plans shall be provided as part of any proposal for all culverts, rockeries, retaining walls, bridges or other specialized features. For purposes of public maintenance, a maximum reach of 16 feet by a backhoe type bucket shall be assumed.

CHAPTER 4 STANDARD DRAWING INDEX

CHAPTER 5
DRAINAGE

5-01 INTRODUCTION

Chapter 5 of the Snohomish County Engineering Design and Development Standards contains standards and specifications for drainage facilities located in County road rights-of-way, in private tracts and easements, or that implement approved best management practices for which the County has some responsibility to operate or maintain. This chapter is intended to be used in coordination with the Snohomish County Drainage Manual and Snohomish County Code (SCC or County Code), primarily chapters 7.53 (Water Pollution Control), 30.63A (Drainage), 30.63B (Land Disturbing Activity), and 30.63C (Low Impact Development). The drainage facilities described above shall be designed and constructed in accordance with the requirements of County Code, the Drainage Manual and these Standards. The County Engineer (the Engineer) or the Director of Planning and Development Services, as authorized by code, may impose additional or more stringent requirements than those specified in this chapter to mitigate drainage impacts; to protect public health, safety and welfare; or to comply with adopted codes and regulations.

This chapter is organized into two parts. Part I - General Standards, contains standards and specifications for drainage system components such as catch basins, pipes, and drains. Part II - Stormwater Flow Control and Treatment, contains standards and specifications for stormwater flow control and treatment facilities, which are typically composed of multiple drainage system components.

PART I – GENERAL STANDARDS

5-02 FACILITY LOCATION

Stormwater flow control and treatment facilities required for private land development shall not be located in the public right-of-way. Pursuant to SCC 30.63A.605, these facilities shall be located in separate lots or tracts. The County Engineer may approve, pursuant to SCC 30.63A.605 and SCC 30.63A.830, these facilities to be located in an easement, including an easement for a private road, if such placement is reasonably necessary to address special circumstances pertaining to the development proposal.

Detention, retention or infiltration facilities described in this chapter shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall these facilities be located within 50 feet of the top of an erosion hazard area or landslide hazard area.

5-03 CONVEYANCE SYSTEMS

A. Natural and Artificial Systems

Conveyance systems are drainage facilities, both natural and artificial, that collect, contain, and convey stormwater runoff. Natural conveyance systems include, but are not limited to, swales, wetlands, drainage courses, streams, and rivers. Artificial conveyance systems include, but are not limited to, gutters, ditches, pipes, catch basins, manholes, constructed wetlands, open channels and swales.

Any requirement for artificial conveyance systems, where natural systems already exist, shall not eliminate or supersede any code requirements for protection of the natural systems.

B. Design

1. Hydraulic flow capacity and velocity for conveyance systems shall be calculated using the Manning Formula. Coefficients for specific conditions are provided in Table 5-1 below.
2. For drainage areas less than 25 acres, the Rational Method or its equivalent shall be used to predict design flows for conveyance systems pursuant to SCC 30.63A.740. For drainage areas of 25 acres or more, the Natural Resources Conservation Service (NRCS) TR-55 program, the Santa Barbara Urban Hydrograph (SBUH), or an equivalent method shall be used.

5-04 CONVEYANCE SYSTEMS - OPEN CHANNELS

(Standard Drawing: 5-010)

A. Design

1. Drainage conveyance systems in rural areas shall be:
   a. open, vegetation-lined channels for channel gradients up to 8%, or
   b. open, rock-lined channels for gradients of 8% through 15%, or
   c. enclosed pipe systems for gradients exceeding 15%.

2. Alternatives to the open, vegetation-lined channel standard for grades up to 8% may be approved if:
   a. construction of the vegetation-lined channel will require an EDDS deviation for some other reason; or
   b. the director determines that an open channel presents an unacceptable public health or safety risk; or
   c. a low impact development (LID) feature, with other specific design requirements, is approved as part of the conveyance system.

3. Open channel, vegetation-lined systems may also be approved for conveyance in certain urban areas, such as the Maltby UGA.

4. All ditches and channels shall be designed to provide a minimum freeboard of 6 inches when the design storm maximum flow is 10 cubic feet per second (cfs) or less. A minimum freeboard of 1.0 foot is required when the maximum design flow is greater than 10 cfs.

5. Ditch check dams may be installed across a ditch or swale to reduce flow velocity and dissipate energy. Ditch check dams shall be constructed in accordance with BMP C207 of the Drainage Manual.

6. Rock-lined channels with gradients exceeding 8% shall be designed by a professional civil engineer and approved by the Engineer. The design shall be based on soils and hydraulic analyses, and shall include rock sizing, filter blanket gradations and/or geotextile fabric.

7. Rock-lined open channels shall be lined with quarry spalls, or an acceptable alternative from the WSDOT Qualified Product List, that meet the requirements of Chapter 9-13 of the WSDOT Standard Specifications. The quarry spalls shall be placed to form a firm, dense protective mat consistent with Standard Drawing 5-010. They shall conform to the typical ditch section and profile. Individual rocks shall not protrude more than three inches from the ditch surface. Ditch dimensions shall be based on calculated stormwater flows.

8. The Engineer may require installation of a closed (pipe) drainage system under a paved shoulder with asphalt thickened edge under certain circumstances. See Standard Drawing 5-010.

9. Under exceptional conditions of erodibility or water velocity, the Engineer may require more stringent methods to control erosion and sediment transport.

B. Friction Coefficients

The Manning coefficient values shown in Table 5-1 shall be used for design of open channel conveyance systems. For other materials, designers shall use values contained in the current WSDOT Hydraulics Manual or the "Normal" value shown in Open Channel Hydraulics, Ven Te Chow, 1959. Designers shall justify the source of the Manning coefficient value used if different from the values below**.**

Table 5-1 Open Channel Friction Coefficients

STANDARD OPEN CHANNEL FRICTION COEFFICIENTS	
GRASS	0.025
ROCK, 8 INCH AND LARGER	0.050
ROCK, SMALLER THAN 8 INCH	0.030
SMOOTH CONCRETE OR ASPHALT	0.015

5-05 CONVEYANCE SYSTEMS - PIPES

(Standard Drawings: 5-030, B-55.20-00, B-70.20-00, 5-060, 5-070, 5-080A, B & C, 5-085 and 5-090)

A. Slope

Pipes 18 inches and less in diameter shall be laid with a minimum slope of 0.5%. Pipes installed as water level equalizers, fish passages, and/or internal components of a detention/retention system may have a flatter slope if approved in the project plans.

B. Flow Velocity

The minimum flow velocity in a conveyance pipe shall be three (3) feet per second when flowing full.

C. Minimum Size

Conveyance pipes, including driveway culverts but not yard drain pipe systems described in subsection 5.05.G below, shall have a minimum diameter of 12 inches. In special cases, such as conflict with underground utilities where redesign would cause unusual hardship, the Engineer may approve the use of 8-inch pipe, provided its length does not exceed 60 feet. If 8-inch pipe is approved, the pipe shall be constructed of smooth-walled material (such as concrete, cast iron, double-walled polyethylene, or equivalent material meeting

the specifications of Section 7-04.2 of the WSDOT Standard Specifications). Installation shall meet or exceed the manufacturer's specification for pipe cover requirements.

Replacement of any existing pipe shall be with an equivalent diameter or larger pipe. The replacement pipe shall meet the material specifications for culvert pipe or storm sewer pipe in Sections 7-02.2 and 7-04.2 of the WSDOT Standard Specifications, respectively.

D. Friction Coefficients

The Manning coefficient values shown in Table 5-2 shall be used for pipe system design. For other types of pipes and/or materials, designers shall use values contained in the current WSDOT Hydraulics Manual or the "Normal" value shown in Open Channel Hydraulics, Ven Te Chow, 1959. Designers shall justify the source of the Manning coefficient value used if different from the values below.

Table 5-2 Pipe Friction Coefficients

STANDARD PIPE FRICTION COEFFICIENTS	
PIPE	**COEFFICIENT,** n
Concrete, smooth wall	0.012
Corrugated steel or aluminum	0.024
Corrugated polyethylene (HDPE)	0.024
Corrugated polyethylene, smooth interior	0.012
Polyvinyl chloride (PVC)	0.012

E. Headwater Depth

For circular culverts, box culverts and pipe arches, the maximum headwater depth for the design storm shall not exceed 2.0 times the culvert height for culverts 18 inches and less, or 1.5 times the culvert height for culverts greater than 18 inches.

For bottomless culverts, the headwater depth of the 100-year storm shall not exceed the top of the culvert.

F. Wyes and Tees

Wye or tee pipe connections may be used for roof/footing/yard drain systems with pipes 8 inches or less in diameter on private property. Cleanouts are required upstream of each wye or tee. Connection of private drain systems to the public drainage system in the right-of-way shall be made only at a catchbasin or manhole.

G. Yard Drain Systems

Yard drain system details are provided in Standard Drawing 5-030. Minimum pipe diameter for a single, residential roof/footing/yard drain system on private property is 4 inches. Systems serving multiple dwellings will require 6-inch or 8-inch pipe. Yard drain system

pipes in the public right-of-way shall have a minimum diameter of 12 inches and may connect to the public drainage system only at a catchbasin or manhole.

H. Drainage Stub-Outs

1. Drainage stub-outs shall be provided for each proposed lot to be served by a new drainage pipe system only if individual lot infiltration systems or dispersion systems are not provided for on-site stormwater management per SCC 30.63A.525. Infiltration, dispersion or stub-out systems shall be designed and constructed in accordance with the Drainage Manual and the EDDS.
2. Each drainage stub-out, if installed, shall connect to the pipe conveyance system at the lowest elevation on the lot abutting the drainage system whenever possible, so that stormwater will be conveyed from all future roof downspouts, driveways, and yard drains. This requirement shall not preclude the connection of footing drains or other subsurface drains. If a low area exists on the opposite side of a proposed driveway, an additional stub-out shall be installed to capture that drainage.
3. Each drainage stub-out shall have free-flowing drainage to an existing or proposed yard drain, dispersion trench or other structure on the pipe conveyance system or to an approved outfall location.
4. Drainage stub-outs shall be clearly marked at the time of drainage system construction.
5. Drainage stub-outs that are designed and/or installed at an elevation that may allow runoff from the main drainage system to backflow into the stub-out at design flow conditions shall be required to have a backwater flow prevention device installed at the upstream end of the stub-out.
6. For lots without individual roof downspout infiltration systems, downspout dispersion systems, or perforated stub-out connections, runoff from roof and footing drains shall be connected by non-perforated pipe to a standard catchbasin within the development's storm drainage system, using yard drains as shown on Standard Drawing 5-030.

I. Pipe Placement and Materials

1. Construction of and materials for culverts and storm sewers shall comply with the WSDOT Standard Specifications Chapters 7-02 and 7-04, respectively, and AASHTO specifications. Pipe materials shall comply with Chapter 9-05 of the WSDOT Standard Specifications with the following additions and clarifications.
2. Corrugated polyethylene pipe is an acceptable alternative for Schedule A culvert pipe and for storm sewer pipe as specified in Chapters 7-02 and 9-05 of the WSDOT Standard Specifications. Corrugated polyethylene pipe shall be double-walled (smooth interior).
    a. Culvert pipe shall meet the requirements of AASHTO M 294 Type S or D for pipe 12 to 60 inches in diameter.
    b. Storm sewer pipe and fittings shall meet the requirements of AASHTO M 294 Type S or D.

3. Pipe installation shall comply with Chapter 7-08 of the WSDOT Standard Specifications and WSDOT Standard Plan B-55.20-00. For burial depths exceeding 15 feet, culvert and storm sewer pipe selection may vary in accordance with schedules in WSDOT Standard Specifications 7-02 and 7-04, respectively. Maximum and minimum depths of cover appropriate for various pipe materials and specifications are provided in the Fill Height Tables in Chapter 8 (Pipe Classifications and Materials) of the WSDOT Hydraulics Manual.
4. Galvanized steel pipe shall have asphalt coating Treatment 1 as specified in WSDOT Standard Specification 9-05.4. Aluminized steel pipe may be used without Treatment 1.
5. Where alternate materials are permissible (i.e. different types of storm sewer pipe, concrete, CMP, polyethylene, etc.), such alternate materials shall be clearly denoted on the road construction plans. Alternate materials may be substituted in the field provided they are listed on the WSDOT Qualified Product List.
6. Corrugated metal pipe and treated corrugated steel pipe, except aluminized, shall not be used in streams, in or downstream of wetlands, in hydric soils, or as any part of a detention, retention, infiltration, or treatment system. Aluminized metal pipe may be used in streams, in or downstream of wetlands, in hydric soils, or in any part of a detention, retention, infiltration, or treatment system.
7. Pipe shall be laid on a straight line and grade between catchbasins.
8. Placement of parallel pipes shall comply with the pipe clearance specifications of WSDOT Standard Plan B-55.20-00.
9. All pipes shall have a minimum of 12 inches cover at the top of the bell, or cover per manufacturer's specifications, whichever is greater.
10. Where pipes of dissimilar material or size are joined, a catchbasin shall be installed.

J. Pipe Joints

All pipes shall be tightly joined except with the Engineer's approval, pipe systems that are designed to collect or disperse stormwater along the length of the pipe. Pipe joints shall meet the construction and testing requirements of Chapters 7-04, 9-04 and 9-05 of the WSDOT Standard Specifications.

K. Leak Testing

Leak testing, as set forth in WSDOT Standard Specification 7-04.3, shall be required as specified by the Engineer.

L. Pipe Ends and Outfall Systems

1. Driveway culverts and cross-culverts, 30 inches or less in diameter, projecting from driveways or roadway side slopes shall be beveled as shown on WSDOT Standard Plan B-70.20-00. Larger diameter pipes will require headwalls for structural stability and safety bars. Refer to the WSDOT Design Manual, Standard Plans, and Standard Specifications (Sections 7-02.3 and 9-05.18) for design requirements.

2. Pipes or culverts shall be provided with outfall discharge protection as discussed in Volume V, Section 4.5.3 of the Drainage Manual and shown in Standard Drawing 5-060. The minimum requirement for all outfalls is a rock splash pad.
3. Headwalls in any stormwater detention or water quality system shall be concrete or rock riprap with mortar. Refer to the WSDOT Hydraulics Manual or to FHWA Hydraulic Engineering Circular No. 11 (Design of Riprap Revetment) for riprap design.

M. Energy Dissipation and Flow Dispersion

1. An energy dissipator, such as a gabion dissipator or engineered energy dissipator, may be required for freshwater outfalls with a design velocity greater than 10 feet per second. Refer to Volume V of the Drainage Manual.
2. Engineered energy dissipation shall be provided at outfalls, where velocities will be excessive for site conditions, in accordance with the WSDOT Hydraulics Manual or FHWA Hydraulic Engineering Circular No. 14 (Hydraulic Design of Energy Dissipators for Culverts and Channels).
3. Level spreader trenches and dispersion swales shall conform to the following standards and specifications. Refer to Standard Drawings 5-070, 5-080A, B and C.
    a. Level spreader trenches and swales shall not be installed in critical areas, as defined by Snohomish County Code.
    b. The maximum design inflow rate for a level spreader is 0.5 cubic feet per second.
    c. The maximum allowable ground slope for surface flow into and out of a level spreader trench is 5%, unless an energy dissipater is provided. In any case, the maximum allowable ground slope for surface flow into or out of a level spreader trench is 20%.
    d. The trench and the dispersion device must be level. No wood structures are allowed due to breakdown and settlement over time. Preferred materials for the dispersion device are concrete, such as a concrete curb section or poured-in-place footing, or PVC lumber with anchor posts. Notches in the dispersion device shall be v-shaped as shown on Standard Drawings 5-080A and B. The dispersion device shall be placed and anchored so that the top of the dispersion device is 1 inch above ground level. Additional flow-spreading design options are discussed in Volume V of the Drainage Manual.
    e. Level spreader trenches shall not result in a point source discharge onto an adjacent property.
    f. Level spreader trenches shall not be located closer than 20 feet upstream from any adjoining downstream property.
    g. For the grass swale dispersion system, the swale and drain rock dispersion berm shall extend a minimum of 10 feet downstream from the level spreader. Refer to Standard Drawing 5-070.
    h. Minimum separation between trenches shall be 50 feet laterally and 100 feet along the discharge flowpath.

i. Tightline systems may be required to prevent the creation or aggravation of downstream erosion conditions. An energy dissipation device for a tightline system is the diffuser tee, shown in Standard Drawing 5-085.

N. Pipe Trenches

1. The excavation, bedding, backfill, and compaction requirements for utility and storm drainage trenches are as set forth in Chapter 7-08 of the WSDOT Standard Specifications and as shown on WSDOT Standard Plan B-55.20-00. Backfill compaction shall be by mechanical means.
2. Trenches that cross streams or wetlands, are dug on slopes in excess of 8%, or that intercept perched water may transport water to unintended locations. Trench plugs or anti-seep collars shall be installed every 50 feet in the trench.
3. Trenches installed in the hyporheic zone of a stream require free-draining backfill and trench plugs or anti-seep collars. Trench plugs or anti-seep collars shall be installed as necessary to control flow through the trench.
4. The material for the trench plug shall be less permeable than the sides of the trench and shall support the roadway, and other loads, without differential settlement. When installed in a roadway prism, the top of the trench plug or anti-seep collar shall match the bottom of the roadway surfacing material (gravel base or crushed surfacing top course).

O. Debris Barriers

Debris barriers shall be designed and installed at entrances to and exits from enclosed drainage systems that are 18 inches or larger in diameter. Cross-culverts and driveway culverts shall be exempt from this requirement. Refer to Standard Drawing 5-090.

5-06 DRAINS

A. Specifications

Drains, including underdrains, shall conform to Chapter 7-01 of the WSDOT Standard Specifications. Authorized pipe materials shall be as specified in Section 7-01.2 of the Standard Specifications and the current revisions of the AASHTO M252 or M294 Specifications. An exception is galvanized or Treatment 1 corrugated metal pipe shall not be used in streams, in or downstream from wetlands, in acid-based soils, or for any part of a stormwater detention/retention system or drainage storage system.

B. Geotextile Fabric

Geotextile filter fabric shall be placed in underdrain trenches in accordance with the manufacturer's recommendations and these Standards. There shall be a one foot minimum overlap of the fabric when the geotextile fabric is wrapped around a trench section. Chapter 9-33 of the WSDOT Standard Specifications shall be used for determining the geotextile fabric properties required.

5-07 CATCHBASINS, MANHOLES AND INLETS

(Standard Drawings: B-05.20-00, B-05.40-00, B-05.60-00, B-10.20-00, B-25.60-00, 5-120, B-15.20-00, B-15.40-00, B-15.60-00, 5-170, 5-260, 5-265 and 5-270B & C)

A. Design

1. Chapter 7-05 of the WSDOT Standard Specifications applies to catchbasins, manholes and curb inlets unless otherwise specified.
2. Catchbasin and manhole design assumes soil load-bearing capacity of 3,300 pounds per square foot (psf). Where the soil capacity is less, the catchbasin or manhole bases shall be designed by a licensed engineer.
3. Manholes shall not be used except for special situations, such as angle points, difficult access or constricted areas, approved by the Engineer.
4. Maximum spacing on surface drainage courses between catchbasins, manholes or inlets shall be as shown in Table 5-3.

Table 5-3 Catchbasin, Manhole or Inlet Spacing

CATCHBASIN, MANHOLE OR INLET SPACING	
ROAD GRADE	**SPACING**
LESS THAN 1.0%	150 Feet
1.0% TO 3.0%	200 Feet
3.0% OR GREATER	300 Feet

5. Additional catchbasins shall be installed as needed to confine drainage to the gutter and prevent flow into traffic lanes or intersections. On cul-de-sacs and curves, inlet spacing shall be measured along the flow line of the roadway.
6. The maximum spacing between storm sewer access structures, whether catchbasins or manholes, or between a high point and an access structure, shall be 300 feet.
7. Connection of private roof/footing/yard drain systems to the public drainage system in the right-of-way shall be made only at a catchbasin or manhole.

B. Types of Catchbasins

1. The following catchbasins may be used in storm sewers:

CB Type 1	WSDOT Std. Plan B-5.20-00
CB Type 1-L	WSDOT Std. Plan B-5.40-00
CB Type 1-P	WSDOT Std. Plan B-5.60-00
CB Type 2	WSDOT Std. Plan B-10.20-00

2. Concrete inlets and Type 1, Type 1-L, and Type 1-P catchbasins shall not be used in storm sewers where the depth from the finished grade to the invert of the lowest pipe exceeds 5 feet. Type 2 catchbasins shall be used instead.
3. Type 2 catchbasins, in which flow control structures (FROPs, baffles, weirs, orifices) are installed, require sufficient space for access and maintenance, which is determined by the size and placement of the control structures. Minimum size requirements for these catchbasins are as follows:
    a. A minimum clearance of 2 feet is required between the outside surfaces of the control structure and the access ladder and any inlet pipes, except where specified differently below. Refer to Standard Drawings 5-270B and C.
    b. An oil pollution control catchbasin (Standard Drawing 5-270C) or flow control catchbasin with a capped top of standpipe may have a 48-inch minimum diameter.
    c. A 54-inch minimum diameter is required if the top of the standpipe is not capped.
    d. If multiple standpipes are installed:
        - 6 inches minimum separation is required between the pipes, and
        - the clearance distance between the standpipes and the ladder and between the standpipes and the inlet/outlet pipes must be increased to 2 feet plus the diameter of the widest standpipe.
    e. A 72-inch minimum diameter is required for a flow restrictor, baffle or weir. Refer to Standard Drawings 5-260 and 5-265.
4. Access ports shall be installed in Type 2 catchbasins over the ladder and over the control structure if installed. If a baffle or weir wall is installed, access shall be provided to each side of the baffle or weir wall. Refer to Standard Drawings 5-260 and 5-265.
5. In special cases, such as conflict with existing underground utilities, the Engineer may approve the use of concrete inlets as shown on WSDOT Standard Plan B-25.60-00.
6. Details for catchbasin circular frames and covers, including reinforcement of the flat slab tops, are shown on Standard Drawing 5-120.

C. Types of Manholes

1. Where the use of a manhole has been approved by the Engineer, the manhole shall be one of the following types:

MH Type 1	WSDOT Std. Plan B-15.20-00
MH Type 2	WSDOT Std. Plan B-15.40-00
MH Type 3	WSDOT Std. Plan B-15.60-00

2. Details for manhole circular frames and covers, including reinforcement of the flat slab tops, are shown on Standard Drawing 5-170.

D. Extension Risers

Extension sections or risers shall be installed as indicated on the above referenced standard drawings for catchbasins and manholes and shall be of the material indicated.

E. Ladders, Steps and Handholds

Catchbasin and manhole ladders, steps, and handholds shall conform to Standard Drawings 5-120 and 5-170. The step locations shall conform to the WSDOT Standard Plan for the applicable structure indicated in subsection B or C above.

F. Cover

All catchbasin and manhole structures shall be covered, as a minimum, up to the base of the frame for the grate or solid lid by compacted soil or appropriate paving material.

5-08 FRAMES, GRATES AND COVERS

(Standard Drawings: B-30.10-00, B-30.20-01, B-30.30-00, B-30.40-00, B-25.20-00, 5-220A, 5-220B, 5-225 and 5-230)

A. Materials

Unless otherwise specified, materials and installation shall conform to the specifications of the WSDOT Standard Specifications. In particular, cast (gray) iron products shall conform to the requirements of AASHTO M306 and ductile iron to ASTM Designation A536, Grade 80-55-06. All metal castings shall meet the proof load testing requirements of AASHTO M306.

B. Types of Frames, Grates and Covers

1. Unless specified otherwise in these Standards, a 20-inch x 24-inch ductile iron frame and grate shall be used for drainage structures located within the road prism. See WSDOT Standard Plan B-30.10-00 for details.
2. When a structure does not function as an inlet to the drainage system, a solid locking cover shall be installed in accordance with WSDOT Standard Plan B-30.20-01.

3. Where the roadway grade is 4% or greater, a ductile iron vaned grate shall be installed in accordance with WSDOT Standard Plan B-30.30-00 or B-30.40-00.
4. A through-curb inlet frame shall be used on arterial roadways, where conditions limit the effectiveness of a flat surface inlet, in accordance with WSDOT Standard Plan B-25.20-00. Examples of such conditions include, but are not limited to, road grades exceeding 12%, locations where there is a high likelihood of clogging from debris, such as sag vertical curves, and locations where surface flow is likely to flow over a curb. Grates used in through-curb inlets shall be ductile iron vaned grates.
5. All grates and associated products shall provide for the safe accommodation of non-motorized as well as motorized transportation.
6. Projects designed with rolled curbs shall use standard frames and grates instead of rolled curb frames and grates. Refer to WSDOT Standard Plans B-30.10-00, B-30.20-01, B-30.30-00 and B-30.40-00. EDDS Standard Drawings 5-220A, 5-220B and 5-225 for rolled curbs are provided for reference specifications and replacement purposes only.
7. Specifications for catchbasin or manhole rings and covers are provided in Standard Drawing 5-230.

C. Lettering

The top surfaces of grates and covers shall be embossed in block lettering as follows:

- "DRAIN": three-inch letters on all solid covers.
- "OUTFALL TO STREAM, DUMP NO POLLUTANTS": 1/2-inch letters on all grates.

D. Securing Grates and Covers

All solid covers and grates shall be secured with 5/8-inch stainless steel socket head cap screws as depicted on the Standard Drawings. A light coating of anti-seize thread compound shall be applied to the screws at the time of installation. The anti-seize compound used shall be Loctite 767 or approved equivalent, applied according to the manufacturer's recommendations.

5-09 OTHER MATERIALS

Subject to prior approval by the Engineer, other types and materials of pipe, geotextile fabric, and drainage hardware may be used provided that recognized specifications are available to control quality and acceptable user experience with the product can be shown. Drainage items on the WSDOT "Qualified Products List" will be accepted.

PART II – STORMWATER FLOW CONTROL AND TREATMENT

This section contains engineering standards for design and construction of stormwater flow control and treatment facilities. These systems are categorized herein as open systems (e.g., ponds and open filters), trenches, and closed systems (e.g., pipes and vaults). These categories are useful because many design features within each group, for example, earthen berms for open systems, are common to different systems in the group.

Many of these systems can provide both flow control and treatment, and the designer must also refer to Chapter 30.63A SCC (Drainage) and the Snohomish County Drainage Manual for project-specific selection of appropriate stormwater facilities. The Snohomish County Drainage Manual also contains additional design information, including information about hydrologic analyses.

Standards and specifications for various drainage system components, such as catchbasins, that may be part of flow control and treatment facilities are presented in other sections of the EDDS or in documents incorporated by reference. Unless otherwise noted in the Drainage Manual, those standards and specifications apply.

OPEN SYSTEMS

5-10 DETENTION PONDS

(Standard Drawings: 5-240A, 5-240B, 5-245, 5-250A & B, 5-260, 5-265, 5-270A & B, and 5-275)

A. General

1. Detention ponds shall be designed as flow-through systems, with the exception of parking lot detention, which may utilize a back-up system. Flow must enter through a conveyance system separate from the control structure and outflow conveyance system. The distance between the inlet and outlet should be maximized to promote sedimentation. Refer to Standard Drawings 5-240A & B, and 5-245.
2. Standards for wetponds, which are detention ponds that retain a permanent pool of water at least during the wet season, are provided in Volume V of the Drainage Manual.
3. Detention pond bottoms shall not be wider than 30 feet at the bottom, unless an access/maintenance road is constructed into the bottom of the facility.
4. Detention pond bottoms shall be level.
5. The elevation of the detention pond bottom shall be a minimum of 0.5 feet below the invert inlet and invert outlet elevations.
6. State regulations require review and approval by the Washington State Department of Ecology Dam Safety Office of detention ponds that impound 10 acre-feet or more. Requirements imposed by the Dam Safety Office shall supersede any conflicting requirements contained in these Standards.
7. Detention ponds shall not be located within 200 feet of the top of an erosion hazard or landslide hazard area as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall detention ponds be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
8. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.

B. Berms

1. Berm section details are provided in Standard Drawing 5-240B:
   a. Earthen berms higher than 6 feet must be designed by a professional engineer with geotechnical expertise.
   b. Earthen berms 6 feet or less in height shall have a minimum top width of 6 feet, unless otherwise specified by a professional engineer with geotechnical expertise.
   c. If a maintenance access road is installed on the berm, the berm shall meet the access road requirements of Section 5-10.I.

2. Earthen berms greater than 4 feet in height must be constructed by excavating a key equal to 50 percent of the berm cross-sectional height and width, unless specified otherwise by a geotechnical engineer.
3. Interior (water-side) slopes of earthen berms shall have a maximum slope of 3 horizontal to 1 vertical. Exterior (non-water-side) slopes of earthen berms shall have a maximum slope of 2 horizontal to 1 vertical.
4. Earthen berms must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a geotechnical engineer) free of loose surface soil materials, roots, and other organic debris.
5. Earthen berms shall be constructed of material with the following characteristics per the United States Department of Agriculture's Textural Triangle: a minimum of 20% silt and clay, a maximum of 60% sand, a maximum of 60% silt, with nominal gravel and cobble content. Alternatively, berms may be constructed of material meeting the specifications of Table 5-4. Alternative specifications prepared by a licensed engineer with geotechnical expertise may also be submitted for approval.

Table 5-4 Earthen Berm Material Specifications

BERM MATERIAL SPECIFICATIONS	
SIEVE SIZE	**% PASSING**
4 inches square	100
US No. 4	30 - 80
US No. 200	15 - 30

6. Compaction of earthen berms shall be accomplished in such a manner as to produce a dense, low permeability engineered fill that can tolerate post-construction settlements with a minimum of cracking. The fill shall be placed on a stable subgrade and compacted to a minimum of 95% of the maximum density, as determined by the requirements of the WSDOT Standard Specifications Section 2-03.3(14)C - Compacting Earth Embankments.
7. The top of an earthen berm shall be at least 1 foot above the emergency spillway, subgrade, or the water surface elevation at the overflow structure occurring at the 100-year, 15-minute flow rate predicted by an approved continuous runoff model. The 100-year, 15-minute flow rate is estimated by multiplying the 100-year, 1-hour rate by a factor of 1.6.
8. Anti-seepage collars shall be used on outflow pipes in berms that impound more than 8 feet of water.

C. Concrete / Structural Elements

1. Detention ponds may have vertical concrete sidewalls, provided:
   a. The walls are designed by a licensed structural engineer.

b. The walls are constructed with minimum 3000 psi structural reinforced concrete and are watertight. Porous materials, such as keystone, ecology blocks or rockeries shall not be used as an element of the wall below the waterline unless a deviation is approved by the Engineer.

c. A fence is installed along the top of all wall sections. Fence specifications are provided in EDDS Section 5-10.J.

d. A ladder is installed as a safety access measure.

D. Drains / Liners / Geotextile Materials

Liners are intended to reduce the likelihood that pollutants in stormwater will reach ground water when runoff treatment facilities are constructed. Information about standards and specifications for liners, and selection of liners for different drainage facility components, is set forth in Volume V, Chapter 4.4 of the Drainage Manual.

E. Presettling Basins / Inflow Control Structures

1. A presettling basin is a pretreatment system intended to remove debris, sediment and associated pollutants from stormwater before it enters treatment or flow control facilities. Additional pretreatment systems, such as oil control systems, may be required for some kinds of treatment or flow control systems or for some development or redevelopment projects for which the Stormwater Site Plan has determined the need for additional pretreatment.
2. Presettling basins shall be required to protect the following flow control and treatment systems:
   a. Granular medium filters (e.g., sand filters, zeolite filters, and compost filters).
   b. Stormwater treatment wetlands used either for flow control or treatment.
   c. Infiltration systems used either for flow control or treatment, except on-site infiltration and dispersion BMPs and perforated stub-out connections described in Volume III, Chapter 3 and Volume V, Chapter 5 of the Drainage Manual.
   d. Any flow control or treatment system for which the Stormwater Site Plan has determined that the post-development stormwater generated by the project will contribute a significant amount of sediment or debris to the flow control or treatment system.
3. Presettling basins shall have a wet pool with a dead storage volume of at least 30 percent of the total volume of runoff from the 6-month, 24-hour storm event.
4. Presettling basins may be constructed with earthen berms or vertical concrete walls, or may be contained in closed structures such as vaults or manholes. Earthen berms shall conform to the standards set forth in Section 5-10.B of this chapter. Other structures shall conform to the requirements of these Standards.
5. Presettling basins constructed of earthen material shall be lined in accordance with the requirements of Section 5-10.D of this chapter.
6. The flowpath length-to-width ratio shall be a minimum of 3:1. Interior berms or baffles may be used to achieve this ratio.

7. The depth of the dead storage volume shall be between 4 feet and 6 feet, unless otherwise specified for a particular flow control or treatment system in the Drainage Manual.
8. Inlets and outlets of presettling basins shall be designed to minimize flow velocity and turbulence.
9. The entire area of the presettling basin shall be accessible by maintenance equipment. If the width across the top of the presettling basin is greater than 30 feet, an access road to the bottom of the basin shall be constructed that meets the requirements of Section 5-10.I - Access Roads.
10. Other inflow control structures include flow splitters, which are used for "off-line" systems. General design criteria for flow splitters are provided in Volume V, Chapter 4 of the Drainage Manual; see Standard Drawings 5-250A and 5-250B for two typical designs.

F. Flow Restriction and Oil Pollution Control Structures

1. Flow restrictors utilizing baffles, weirs or other orifice devices shall be contained in Type 2 catchbasins as shown in Standard Drawings 5-260 and 5-265.
2. Flow Restriction / Oil Pollution Control (FROP) Structures:
    a. A FROP structure shall be installed in a separate Type 2 catchbasin or vault outside the impoundment portion of a detention pond. It shall be located where it can function properly and be maintained effectively by a vactor truck.
    b. No part of a FROP or any other flow control structure shall restrict access into the catchbasin. Catchbasin size may need to be increased to provide adequate space for access and maintenance; refer to Section 5-07.B for requirements.
    c. A FROP structure shall be constructed and installed in accordance with Standard Drawings 5-270A and B, or as specified by the Engineer. The FROP-T shear gate shall be as specified on Standard Drawing 5-275.
    d. A riser pipe to serve as a primary overflow shall be provided as shown in Standard Drawing 5-270B. The riser pipe shall be able to bypass the 100-year developed peak flow over or around the restrictor system.
    e. A FROP structure shall be provided with a solid, round, locking lid. It shall be so located and installed such that no storm drainage will enter the structure through the access hole or the top slab or risers.
3. Oil Pollution Control Structures:
    a. An oil pollution control unit shall be installed in a separate Type 2 catchbasin located where it can function properly and be maintained effectively by a vactor truck.
    b. The oil pollution control unit shall be constructed and installed in accordance with Standard Drawing 5-270C, or as specified by the Engineer, so that access into the catchbasin is not restricted.
    c. The shear gate shall be as specified on Standard Drawing 5-275.

d. The oil pollution control unit shall be provided with a solid, round, locking lid. It shall be located and installed such that no storm drainage will enter the structure through the access hole or the top slab or risers.

G. Emergency Overflow Systems

An emergency overflow system allows water to exit a drainage facility by a selected path other than the standard outlet structure without causing damage to the drainage facility, such as erosion of an earthen berm.

1. An emergency overflow system shall be provided that conveys the developed site's maximum developed flow from the facility into the downstream drainage system without damage to any drainage facility or system. Overflow systems may be open channel spillways, weirs or closed conduit systems, but shall not be connected to or through the flow control structure. The preferred method to establish the overflow invert elevation in an open channel is a concrete curb or sill. The emergency overflow system for a flow control system shall bypass any water quality treatment system. Refer to Standard Drawing 5-240B.
2. If the emergency overflow system is an open channel, it shall be designed as a broad-crested weir, to pass the 100-year, 15-minute flow rate calculated using a continuous simulation runoff model approved by Snohomish County. The 100-year, 15-minute flow rate is estimated by multiplying the 100-year, 1-hour rate by a factor of 1.6. Earthen channels shall be armored with quarry spalls or riprap that conforms to WSDOT specifications, provided that larger material shall be used if necessary to prevent erosion from the maximum design flow. The quarry spalls or riprap layer shall be at least one foot thick. Individual rocks or riprap pieces shall not protrude more than three inches from the one foot thick layer.
3. The emergency overflow elevation shall be at least 0.2 feet above the water surface elevation occurring at the 100-year, 15-minute flow rate calculated using a continuous simulation runoff model approved by Snohomish County. The 100-year, 15-minute flow rate is estimated by multiplying the 100-year, 1-hour rate by a factor of 1.6. The top of the pond berm shall be at least 1 foot above the elevation of the emergency overflow.
4. Emergency spillway systems for detention ponds that may impound 10 acre-feet or more are governed by the Dam Safety Guidelines of the Dam Safety Office of the Department of Ecology. These requirements shall supersede any requirements of this subsection that may conflict.

H. Weirs Used For Flow Control

1. Weirs shall be designed to control flows in accordance with the calculation methods set forth in the Drainage Manual.
2. Weirs shall have a debris barrier installed directly upstream of the weir.
3. Weir wall structures shall be reinforced concrete on a reinforced concrete pad poured in place for five (5) feet upstream and downstream of the weir wall. The concrete pad shall extend one (1) foot in width to each side of the outside edge of the weir.
4. If a chain link fence is constructed directly over or adjacent to the weir structure, the chain link shall extend to within two (2) inches of the top of the weir, to prevent

unauthorized access to the facility. A bottom rail meeting WSDOT Standard Specifications shall be installed, extending a minimum of five (5) feet horizontally from each edge of the weir.

5. Weirs shall be designed as sharp-crested weirs using end contraction correction factors or other formulas approved by the Engineer.
6. Metal weir plates shall be designed to be field adjusted, bolted, or otherwise fastened to the foundation, not embedded in concrete. Weir plate fasteners that allow field adjustment shall be used.

I. Access Roads

1. Access to detention ponds shall be provided in accordance with Chapter 30.63A SCC.
2. Safe and adequate access shall be provided to operate and/or maintain the detention pond and its controls, to provide for repair and improvement, and to perform maintenance during all times of the year. Detention ponds shall be designed and constructed in a manner that provides safe access and working conditions for personnel, such as placing control structures in accessible locations and not elevating access frames and grates more than four (4) inches above the surrounding terrain. Any appropriate safety measures for personnel access, such as handholds, railings, etc. shall be installed. The Engineer shall determine whether a proposed access and its associated drainage facilities are adequate and safe.
3. Access shall be provided to:
    a. All control structures, including weirs and emergency overflow structures.
    b. All catchbasins and water quality treatment systems associated with the detention pond.
    c. All inlets and outlets of the pond, including level spreader trenches, energy dissipaters, and other pipe ends and pipe end structures.
    d. All catchbasins within the pond.
    e. The bottom of the ponds, except those ponds designed to be maintained from the perimeter.
4. Vehicular access shall meet the following criteria:
    a. The access road shall have a minimum width of 15 feet if a turnaround is provided; a 20-foot minimum width is required if a turnaround is not provided.
    b. The access road shall meet the HL-93 (Load Resistance Factor Design method) loading requirements of AASHTO. At a minimum, the road shall have 6 inches of compacted depth gravel borrow or pit run gravel over a stable subgrade. The gravel shall be well-graded, well-compacted and contain sufficient fines to bind the gravel for traction.
    c. The maximum allowable grade is 15%. If a grade greater than 15% is approved by the Engineer, the road must be paved with a minimum of 2 inches of hot mix asphalt (HMA) over the gravel layer.
    d. Materials shall meet WSDOT Standard Specifications 4-02 (Gravel Base) and 5-04 (Hot Mix Asphalt).

e. A hammerhead turnaround shall be provided if the access road:

- is 75 feet or longer, or
- connects to an arterial road right-of-way, or
- has a grade of 5% or greater, or
- has a horizontal curve radius of 100 feet or less.

f. Hammerhead turnarounds shall have dimensions of 40 feet by 40 feet with a 20-foot inside radius.

J. Fencing

1. The fencing requirements of this subsection are intended to provide permanent safety and security around detention ponds. Temporary fencing for the purpose of identifying boundaries for clearing, sensitive areas and buffers, or construction access, is described in BMPs C103 and C104 of the Drainage Manual.
2. Fencing is required for safety and security purposes around all detention ponds for which the maximum design water depth is greater than 3 feet or the inside slopes are steeper than 3 horizontal to 1 vertical.
3. Fencing is not required if one interior horizontal safety bench with a width of at least 10 feet is provided around the entire perimeter for each three feet of water depth, and the interior sideslopes are no steeper than 3 horizontal to 1 vertical. No benching or fencing is required where side slopes are 4 horizontal to 1 vertical or flatter.
4. Detention ponds that do not require fencing must still be graded to blend with the topography of the site.
5. Fencing and gates shall be Type 1 or Type 3 chain link fence in accordance with WSDOT Standard Specifications and Standard Plans L-10.10 or L-20.10. Line posts for all fences shall be galvanized and set in concrete. Fences shall be no less than six (6) feet in height, from the ground to the top of the chain link. Wooden fences are not allowed as the security fence.
6. The gap between the bottom of the chain link fence and the ground surface shall not exceed two inches.
7. An access opening with a minimum width of 16 feet shall be located at the access route entrance. Two gates of equal length shall be provided for the access opening. Gates shall be designed and constructed in accordance with WSDOT Standard Specifications and Standard Plans L-10.10 or L-30.10. Gates shall include a combination lock.

K. Vegetation

1. Permanent vegetation shall be established on earthen components of drainage facilities using seed mixes recommended in BMP C120, "Temporary and Permanent Seeding," in the Drainage Manual, unless the Drainage Manual specifies different vegetation for a particular drainage facility type.
2. Trees shall not be planted on constructed perimeter berms designed for runoff impoundment. Trees may be planted at the top of open detention ponds that are created solely by excavation (no fill or berms).

3. Within tracts or easements containing detention ponds, landscaping of areas other than those described above shall conform to requirements set forth in SCC 30.25.023. An approved planting list for vegetative screening of stormwater flow control or treatment facilities is provided in Appendix B.

5-11 INFILTRATION PONDS

A. General

1. Infiltration pond bottoms shall not be wider than 30 feet at the bottom, unless an access/maintenance road is constructed into the bottom of the facility.
2. Infiltration pond bottoms shall have a slope of less than 3 percent.
3. Initial basin excavation shall be conducted to within 1 foot of the final elevation of the basin floor. Excavate infiltration ponds or basins to final grade only after all disturbed areas in the up-gradient project drainage area have been permanently stabilized. The final phase of excavation shall remove all accumulated sediment in the infiltration facility before putting it in service.
4. Relatively light-tracked equipment shall be used for excavation of the infiltration pond to avoid compaction of the floor. The use of draglines and trackhoes shall be considered. The area to be used for an infiltration pond shall be flagged or otherwise marked to keep heavy equipment from driving on it.
5. Infiltration ponds shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall infiltration ponds be located within 50 feet of the top of an erosion hazard area or landslide hazard area.

B. Berms

- Standards and specifications for berms in Section 5-10.B - Detention Ponds shall apply to infiltration ponds.

C. Concrete / Structural Elements

- RESERVED

D. Drains / Liners / Geotextile Materials

1. If the infiltration pond is intended to provide treatment, all areas of the pond that are not constructed of native soil and that are below the design water level in emergency overflow conditions shall be lined with a minimum of 18 inches of treatment soil. See Section 4.4.2, Design Criteria for Treatment Liners, of Volume V of the Drainage Manual for treatment soil specifications.
2. Unless otherwise specified, materials and methods shall conform to the 2008 WSDOT Standard Specifications.
3. Infiltration basins may be covered with a 6-inch to 12-inch layer of filter material such as coarse sand, or a suitable filter fabric to help prevent the buildup of impervious deposits on the soil surface.

E. Presettling Basins / Inflow Control Structures

- Standards and specifications for presettling basins and inflow control structures in Section 5-10.E - Detention Ponds shall apply to infiltration ponds.

F. Flow Restriction and Oil Pollution Control Structures

- RESERVED

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to infiltration ponds.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to infiltration ponds.
2. Access to infiltration ponds shall be provided in accordance with Chapter 30.63A SCC.

J. Fencing

- Standards and specifications for fencing in Section 5-10.J - Detention Ponds shall apply to infiltration ponds.

K. Vegetation

1. Standards and specifications for vegetation in Section 5-10.K - Detention Ponds shall apply to infiltration ponds.
2. Infiltration basins designed to provide treatment must have sufficient vegetation established on the basin floor and side slopes to prevent erosion and sloughing and to provide additional pollutant removal.

5-12 BIORETENTION FACILITIES

Bioretention facilities are essentially infiltration basins with two special features: First, the infiltration basin is overexcavated and partially refilled with a special bioretention soil mix that functions as a granular filtration medium to provide stormwater treatment. Second, specific vegetation is planted to maintain the soil's ability to adsorb pollutants and infiltrate water, and to absorb and degrade pollutants captured by the soil. A bioretention facility can be used as a combination flow control / treatment system, or can be designed with an underdrain, which reduces or eliminates the flow control function. There are several configurations of bioretention facilities, the most common of which is an enclosed basin. The standards and specifications in this section apply to all configurations.

A. General

1. Minimize compaction of the base and sidewalls of the bioretention area. Excavation shall not be allowed during wet or saturated conditions. Excavation shall be

performed by machinery operating adjacent to the bioretention facility and no heavy equipment with narrow tracks, narrow tires or large lugged, high pressure tires should be allowed on the bottom of the bioretention facility.

2. On-site soil mixing or placement shall not be performed if the soil is saturated. The bioretention soil mixture should be placed and graded by excavators and/or backhoes operating adjacent to the bioretention facility.
3. Bioretention facilities shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall bioretention facilities be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
4. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.
5. Additional design information is provided in Volume III, Chapter 3.3.12 of the Drainage Manual.

B. Berms

- Standards and specifications for berms in Section 5-10.B - Detention Ponds shall apply to bioretention ponds.

C. Concrete / Structural Elements

- Bioretention facilities that are not intended to provide flow control by means of infiltration may be contained in precast concrete vaults or cast-in-place concrete structures. These structures shall conform to all relevant requirements set forth in these Standards.

D. Drains / Liners / Geotextile Materials

1. Standards and specifications for drains, liners, and geotextile fabric set forth in Section 5-10.D - Detention Ponds shall apply to bioretention ponds.
2. Aggregate for underdrain systems shall be clean washed rock of 0.75 inch to 1.5 inch diameter.
3. Underdrain systems, if included in the design, shall be designed in accordance with the requirements for sand filtration treatment facilities described in Volume V, Chapter 8 of the Drainage Manual.

E. Presettling Basins / Inflow Control Structures

- Inlets for bioretention facilities shall be designed to spread influent flow uniformly across the filter bed and to prevent erosion or channeling of the filter bed. The preferred inlet design for a bioretention system is dispersed flow across a vegetated strip, which provides pretreatment and dissipates energy of the influent. If such flow dispersion is not provided, a flow spreader in accordance with Volume V, Chapter 4 shall be installed.

F. Flow Restriction and Oil Pollution Control Structures

- RESERVED

G. Emergency Overflow Structures

- An overflow structure shall be provided in accordance with the requirements for infiltration facility design set forth in Volume III, Chapter 3.3.9 of the Drainage Manual. See surface pool depth criteria in Chapter 3.3.12. For bioretention facilities with contributing drainage areas of less than 1000 square feet, a minimum of 2 inches of freeboard shall be provided, measured from the overflow invert to the lowest point of the top of the slope defining the bioretention facility. For contributing drainage areas of 1,000 square feet or greater, a minimum of 6 inches of freeboard shall be provided.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

- Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to bioretention ponds.

J. Fencing

- Fencing, if required, shall conform to fencing standards and specifications in Section 5-10.J - Detention Ponds.

K. Vegetation

- Vegetation for bioretention facilities shall conform to the requirements set forth in Volume III, Chapter 3.3.12 of the Drainage Manual.

5-13 GRANULAR MEDIA FILTERS

Granular media filters include sand filters, amended sand filters, and other filters containing granular filtration media such as zeolites, compost, activated carbon, and other such materials intended to remove pollutants from stormwater.

A typical granular media filtration system consists of a pretreatment system, flow spreader(s), a horizontal media filtration bed, a geotextile fabric underneath the media bed, and an underdrain system. Some manufactured filters use media-filled canisters instead of a horizontal filter bed. The standards and specifications in this section were developed for horizontal bed sand filters, but should be applicable to other filtration media. Some of the standards and specifications may not be directly applicable to filter configurations other than a horizontal bed filter. Granular media filter vaults are discussed separately in Section 5-17.

Typically, granular media filters are not designed to provide flow control, but there is no reason they cannot do so. For example, bioretention systems (see Section 5-12) can be designed as combination treatment/infiltration systems.

A. General

1. Sand filtration can be used in most residential, commercial, and industrial developments where debris, heavy sediment loads, and oils and greases will not clog or prematurely overload the sand, or where adequate pretreatment is provided for these pollutants. Specific applications include residential subdivisions, parking lots for commercial and industrial establishments, gas stations, high-use sites, high-density multi-family housing, roadways, and bridge decks.
2. Sand filters should be located off-line before or after detention systems.
3. See Volume V, Chapter 8 of the Drainage Manual for hydraulic design requirements.
4. See Volume V, Chapter 8 of the Drainage Manual for filter sand specifications, as applicable.
5. An underground filter should be considered in areas subject to freezing conditions.
6. Sand shall be placed in the filter using a low ground pressure bulldozer or similar equipment (4 psig or less). The sand shall be settled by flooding the filter with a minimum of 10 gallons of water per cubic foot of sand.
7. Granular media filters that are also used for flow control shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall granular media filters be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
8. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.
9. Additional design information is provided in Volume V, Chapter 8 of the Drainage Manual.

B. Berms

- Standards and specifications for berms set forth in Section 5-10.B - Detention Ponds shall apply to granular media filters.

C. Concrete / Structural Elements

- Granular media filters that are not intended to provide flow control by means of infiltration may be contained in precast concrete structures or cast-in-place concrete structures. These structures shall conform to all relevant requirements set forth in these Standards.

D. Drains / Liners / Geotextile Materials

1. Standards and specifications for drains, liners, and geotextile fabric set forth in Section 5-10.D - Detention Ponds shall apply to granular media filters.
2. Aggregate for underdrain systems shall be clean washed rock of 0.75 inch to 1.5 inch diameter.
3. For granular media filters installed upstream of flow control systems, underdrain piping shall be sized to pass double the two-year return frequency flow indicated by

the Western Washington Hydrology Model (WWHM), calculated with one foot of hydraulic head above the invert of the upstream end of the collector pipe.

4. For granular media filters installed downstream of flow control systems, underdrain piping shall be sized to pass the two-year return frequency flow indicated by WWHM, calculated with one foot of hydraulic head above the invert of the upstream end of the collector pipe.
5. The internal diameter of underdrain pipes shall be a minimum of 6 inches.
6. Underdrain pipes shall have two rows of 1/2-inch holes spaced 6 inches apart longitudinally (maximum), with rows 120 degrees apart (laid with holes downward).
7. The maximum perpendicular distance between two feeder pipes shall be 15 feet.
8. The main collector underdrain pipe shall have a minimum slope of 0.5 percent.
9. Geotextile fabric shall be installed between the granular filter medium and the aggregate for the underdrain system.
10. One inch of aggregate of the type used for the underdrain system shall be placed above the fabric.
11. Cleanout wyes with caps or junction boxes shall be provided at both ends of the collector pipes. Cleanouts shall extend to the surface of the filter. A valve box shall be provided for access to the cleanouts.
12. Access for cleaning all underdrain piping shall be provided. This may consist of installing cleanout ports, which tee into the underdrain system and surface above the top of the sand bed.
13. An inlet shutoff/bypass valve for the filter shall be installed.
14. Concrete liners may be used for sedimentation chambers and for sedimentation and sand filtration basins less than 1,000 square feet in area. Concrete shall be 5 inches thick Class A or better and shall be reinforced by steel wire mesh. The steel wire mesh shall be 6 gauge wire or larger and 6-inch by 6-inch mesh or smaller. An "Ordinary Surface Finish" is required. When the underlying soil is clay or has an unconfined compressive strength of 0.25 ton per square foot or less, the concrete shall have a minimum 6-inch compacted aggregate base. This base must consist of coarse sand and river stone, crushed stone or equivalent with diameter of 0.75- to 1-inch.
15. If an impermeable liner is not required and the basin has not been excavated to bedrock, a geotextile fabric liner shall be installed that retains the sand and meets the following requirements:
    a. For sand filter drain strip between the sand and the drain rock or gravel layers, the geotextile fabric shall meet specifications for moderate survivability set forth in the WSDOT Standard Specifications, Section 9-33.1, Geosynthetic Material Requirements, Table C.1.
    b. For sand filter matting located immediately above the impermeable liner and below the drains, a nonwoven geotextile fabric shall be used that meets specifications for moderate survivability set forth in the WSDOT Standard

Specifications, Section 9-33.1, Geosynthetic Material Requirements in Table 1 and filtration properties for Class C in Table 2.

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins and inlet control structures in Section 5-10.E - Detention Ponds shall apply to granular media filters.
2. Inlet bypass and flow spreading structures shall be designed to minimize turbulence and spread slow evenly across the surface of the filter bed. The maximum distance between the top of the spreader and the top of the sand bed shall be 8 inches. Flows may enter the sand bed by spilling over the top of the wall into a flow spreader pad or alternatively a pipe and manifold system may be used. A pipe and manifold system must retain the required dead storage volume in the first cell and be readily maintainable.
3. The minimum pipe diameter for an inlet pipe and manifold system shall be 8 inches. Multiple inlets are recommended to minimize turbulence and reduce local flow velocities.
4. Erosion protection must be provided along the first foot of the sand bed adjacent to the spreader. Geotextile fabric secured on the surface of the sand bed, or equivalent method, may be used.

F. Flow Restriction and Oil Pollution Control Structures

- As applicable, standards and specifications for flow restriction and oil pollution control structures in Section 5-10.F - Detention Ponds shall apply to granular media filters.

G. Emergency Overflow Structures

- As applicable, standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to granular media filters.

H. Weirs Used For Flow Control

- As applicable, standards and specifications for weirs used for flow control structures in Section 5-10.H - Detention Ponds shall apply to granular media filters.

I. Access Roads

- Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to granular media filters.

J. Fencing

- Standards and specifications for fencing in Section 5-10.J - Detention Ponds shall apply to granular media filters.

K. Vegetation

- RESERVED

TRENCH SYSTEMS

5-14 INFILTRATION TRENCHES

Infiltration trenches are trenches, typically at least 24 inches wide, that are backfilled with gravel, allowing for temporary storage of stormwater until it infiltrates into the adjacent soil. Infiltration trenches may contain a perforated pipe, may have a sand bed underneath the gravel, and the gravel may be covered with geotextile fabric or soil and vegetation.

NOTE: The standards and specifications in this section shall not apply to infiltration or dispersion systems constructed to comply with the on-site stormwater management requirements of SCC 30.63A.525. Standards and specifications for those systems are set forth in the Drainage Manual.

A. General

1. See Volume III, Chapter 3.3.11 of the Drainage Manual for detail drawings of infiltration trenches.
2. Excavate infiltration trenches to final grade only after all disturbed areas in the up-gradient project drainage area have been permanently stabilized. The final phase of excavation shall remove all accumulated sediment in the infiltration facility before putting it in service.
3. An observation well shall be installed at the lower end of the infiltration trench to check water levels, drawdown time, sediment accumulation, and conduct water quality monitoring. Figure 3.36 in Volume III of the Drainage Manual illustrates observation well details. It should consist of a perforated PVC pipe which is 4 to 6 inches in diameter and it should be constructed flush with the ground elevation. For larger trenches a 12-36 inch diameter well can be installed to facilitate maintenance operations such as pumping out the sediment. The top of the well shall be capped to discourage vandalism and tampering.
4. Infiltration trenches shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall such infiltration trenches be located within 50 feet of the top of an erosion hazard area or landslide hazard area.

B. Berms

- RESERVED

C. Concrete / Structural Elements

- RESERVED

D. Drains / Liners / Geotextile Materials

1. Aggregate for an infiltration trench shall consist of clean aggregate with a maximum diameter of 3 inches and a minimum diameter of 1.5 inches. Void space for the aggregate shall be in the range of 30% to 40%.

2. The aggregate fill material shall be completely encased in an engineering geotextile material. Geotextile fabric shall surround all of the aggregate fill material except for the top one-foot, which is placed over the geotextile. The geotextile fabric shall meet the requirements of the WSDOT Standard Specifications, Section 9-33.1, Geosynthetic Material Requirements for low survivability in Table 1 and filtration properties for Class C in Table 2.
3. The stone aggregate shall be placed in lifts and compacted using plate compactors. As a rule of thumb, a maximum loose lift thickness of 12 inches is recommended. The compaction process ensures geotextile conformity to the excavation sides, thereby reducing potential piping and geotextile clogging, and settlement problems.
4. Natural or fill soils shall not be intermixed with the stone aggregate. All contaminated stone aggregate must be removed and replaced with uncontaminated stone aggregate.
5. Following the stone aggregate placement, the geotextile fabric must be folded over the stone aggregate to form a 12-inch minimum longitudinal overlap. When overlaps are required between rolls, the upstream roll shall overlap a minimum of 2 feet over the downstream roll in order to provide a shingled effect.
6. Voids between the geotextile fabric and the excavation sides must be avoided. Natural soils shall be placed in these voids to ensure geotextile conformity to the excavation sides.

E. Presettling Basins / Inflow Control Structures

- Standards and specifications for presettling basins / inlet control structures in Section 5-10.E - Detention Ponds shall apply to infiltration trenches.

F. Flow Restriction and Oil Pollution Control Structures

- RESERVED

G. Emergency Overflow Structures

- RESERVED

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

- Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to infiltration trenches.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

CLOSED SYSTEMS

5-15 DETENTION VAULTS

(Standard Drawings: 5-230 and 5-280)

Detention vaults are structures that detain water in an enclosed concrete vault. Refer to Standard Drawing 5-280.

A. General

1. Wetvaults, which retain a permanent pool of water, are discussed in detail in Volume V of the Drainage Manual.
2. Detention vaults shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall detention vaults be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
3. Detention vaults shall be designed as flow-through systems.
4. Detention vaults for private land development projects shall not be located in the public right-of-way. Vaults may be located in private roads subject to a determination by the Engineer that the private road will not likely be converted to a public road in the future.
5. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.

B. Berms

- RESERVED

C. Concrete / Structural Elements

1. Detention vaults shall be designed with flat bottoms (longitudinally) or sloped toward the inlet to facilitate sediment removal. The distance between the inlet and the outlet should be maximized (as feasible). Flat-bottomed vaults are required to have removable panels over the entire vault for access, with additional features specified by the Drainage Manual.
2. Structural plans for all vaults shall be prepared and stamped by a professional engineer licensed in the State of Washington. The drawings shall include steel placement block-outs for inlet and outlet pipes, corner reinforcement, top attachment, water stops, construction joints, and design mix specifications for the concrete.
3. If the vault is to be covered with soil at project completion, the vault shall be designed for saturated soil loading with a minimum cover of two (2) feet. The design shall be adequate for live loads, dead loads, and seismic loads in accordance with the International Building Code, as amended and adopted as the Snohomish County

Building Code. Vaults shall be watertight and constructed with 3000 psi minimum compressive strength reinforced concrete.

4. Closed vaults shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater when located in the right-of-way or in areas where the lids may be subject to vehicle loads. All design loads shall include an impact allowance in accordance with the AASHTO Standard Specifications for Highway Bridges.
5. The minimum internal height in a closed vault shall be seven (7) feet, the minimum internal width shall be four (4) feet, and the maximum depth from ground elevation to the vault bottom shall be twenty (20) feet.
6. The walls of all vaults shall have horizontal and vertical reinforcement on each face. Reinforcement shall be designed for both the hydrostatic pressure of a tank full of water and the earth pressure of the planned backfill plus any surcharge. The design of corners of vaults shall take into consideration the restraint provided by the adjoining walls and/or the lids.
7. Maintenance access and ventilation for detention vaults shall comply with county, state and national standards.
8. Detention vaults shall have access openings positioned so that every location within the vault is within 50 feet of an access. A ladder shall be provided to the bottom of each cell or compartment. Access points shall be located over the inlet, outlet and the sediment trap. Access shall consist of a round, locking ring and cover in accordance with Standard Drawing 5-230. The ladder shall be directly under the ring and cover. Access design shall provide sufficient clearance between walls and appurtenances to allow access for personnel and required safety and maintenance equipment.
9. The invert elevation of the outlet of the vault shall be elevated above the bottom of the vault to provide an average of 6 inches of sediment storage over the entire bottom of the vault.

D. Drains / Liners / Geotextile Materials

- RESERVED

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins / inlet control structures in Section 5-10 - Detention Ponds shall apply to detention vaults. The presettling basin may be included as a chamber in the vault that provides flow control, or may be contained in a separate structure.
2. Vehicular access designed for AASHTO HL-93 (Load Resistance Factor Design method) loading or greater shall be provided for the sediment removal area. Access adequate for maintenance shall be provided directly over a closed sediment removal structure.

F. Flow Restriction and Oil Pollution Control Structures

1. Standards and specifications for flow restriction and oil pollution control structures in Section 5-10.F - Detention Ponds shall apply to detention vaults.
2. Flow restriction and oil pollution control structures shall be located downstream from the vault in an appropriately sized manhole.
3. The outlet of the structure shall be a minimum of 2 feet above the highest elevation flow control orifice to retain oil within the structure.

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to detention vaults.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to detention vaults.
2. Closed detention systems located where vehicle loads may be imposed shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater.
3. Detention vaults for private land development projects shall not be located in the public right-of-way. However, detention vaults may be located in a private tract or easement, including those for a private road, subject to a determination by the County Engineer that the private road will not likely be converted to a public road in the future.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

5-16 DETENTION PIPES AND TANKS

(Standard Drawings: 5-290, 5-295 and B-55.20-00)

Detention pipes, sometimes referred to as detention tanks, are detention facilities that detain the water in an underground pipe. The pipe may be metal, concrete, or plastic. Fundamentally, detention pipes function identically to detention vaults; the design and construction differences are related to the use of a pipe as opposed to a concrete vault. Refer to Standard Drawings 5-290 and 5-295.

A. General

1. Detention pipes shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall detention pipes be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
2. Detention pipes shall be designed as flow-through systems.
3. Detention pipes for private land development projects shall not be located in the public right-of-way. Detention pipes may be located in private roads subject to a determination by the County Engineer that the private road will not likely be converted to a public road in the future.
4. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.

B. Berms

- RESERVED

C. Concrete / Structural Elements

1. Detention pipes shall conform to Chapter 9-05 of the WSDOT Standard Specifications and the requirements of this chapter. Corrugated metal pipe and treated corrugated metal pipe, except aluminized pipe, shall not be used for any part of a detention pipe.
2. Excavation, bedding, backfill, and compaction used for detention pipes shall conform to Chapter 7-08 of the WSDOT Standard Specifications and the requirements of this chapter.
3. Detention pipes shall have a minimum diameter of 36 inches. Pipes larger than 36 inches in diameter may be connected to adjoining structures with a section of pipe at least 36 inches diameter and no greater than 2 feet in length.
4. Parallel detention pipes shall meet the clearance specifications for multiple pipes shown on WSDOT Standard Plan B-55.20-00, but in no case shall clearance be less than two (2) feet, with appropriate provisions for controlling the density of fill between the pipes.
5. Maintenance access and ventilation for detention pipes shall comply with county, state and national standards.
6. Detention pipes shall have access openings positioned so that every location within the pipe is within 50 feet of an access. A ladder shall be provided to the bottom of each cell or compartment. Access points shall be located over the inlet, outlet and the sediment trap. Access shall consist of a round, locking ring and cover in accordance with Standard Drawing 5-230. The ladder shall be directly under the ring and cover. Access design shall provide sufficient clearance between walls and appurtenances to allow access for personnel and required safety and maintenance equipment.

7. The invert elevation of the outlet of the detention pipe shall be elevated above the bottom of the pipe to provide an average of 6 inches of sediment storage over the entire bottom of the pipe.

D. Drains / Liners / Geotextile Materials

- RESERVED

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins / inlet control structures in Section 5-10.E - Detention Ponds shall apply to detention pipes. The presettling basin may be an open or closed structure.
2. Vehicular access designed for AASHTO HL-93 (Load Resistance Factor Design method) loading or greater shall be provided for the sediment removal area. Access adequate for maintenance shall be provided directly over a closed sediment removal structure.

F. Flow Restriction and Oil Pollution Control Structures

1. Standards and specifications for flow restriction and oil pollution control structures in Section 5-10.F - Detention Ponds shall apply to detention pipes.
2. Flow restriction and oil pollution control structures shall be located downstream from the detention pipe in an appropriately sized manhole.
3. The outlet of the structure shall be a minimum of 2 feet above the highest elevation flow control orifice to retain oil within the structure.

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to detention pipes.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to detention pipes.
2. Closed detention systems located where vehicle loads may be imposed shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater.
3. Detention pipes for private land development projects shall not be located in the public right-of-way. However, detention pipes may be located in a private tract or easement, including those for a private road, subject to a determination by the Engineer that the private road will not likely be converted to a public road in the future.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

5-17 GRANULAR MEDIA FILTER VAULTS

(Standard Drawings: 5-300A & B)

A granular media filter vault is identical in function to an open granular media filter vault; the differences in standards and specifications relate to the filter's placement in a vault as opposed to an open structure. As with closed systems used for flow control, filter vaults are suitable where space or land uses limit or preclude open facilities. Refer to Standard Drawings 5-300A and B. Some additional standards and specifications are set forth in the Drainage Manual for specific types of systems, such as linear sand filters.

A. General

1. Vaults may be designed as off-line systems or on-line systems for small drainages.
2. In an off-line system, a diversion structure shall be installed to divert the design flow rate into the sediment chamber and bypass the remaining flow to a flow control system if one is required by SCC 30.63A.550 through 30.63A.555.
3. Granular medium filter vaults shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall such vaults be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
4. Granular medium filter vaults for private land development projects shall not be located in the public right-of-way. Vaults may be located in private roads subject to a determination by the Engineer that the private road will not likely be converted to a public road in the future.
5. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.
6. General Notes 1 through 4 of Section 5-13.A - Granular Media Filters, General, apply to granular media filter vaults.
7. Additional design information is provided in Volume V, Chapter 8 of the Drainage Manual.

B. Berms

- RESERVED

C. Concrete / Structural Elements

1. General Notes 2 through 6 of Section 5-15.C - Detention Vaults, Concrete/Structural Elements, apply to granular media filter vaults.

2. To prevent anoxic conditions, a minimum of 24 square feet of ventilation grate shall be provided for each 250 square feet of sand bed surface area. For sufficient distribution of airflow across the sand bed, grates may be located in one area if the sand filter is small, but placement at each end is preferred. Small grates may also be dispersed over the entire sand bed area.
3. A shutoff/bypass valve shall be installed.

D. Drains / Liners / Geotextile Materials

1. Standards and specifications for drains, liners, and geotextile fabric set forth in Section 5-10.D - Detention Ponds shall apply to granular media filter vaults.
2. Aggregate for underdrain systems shall be clean washed rock of 0.75 inch to 1.5 inch diameter.

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins/inlet control structures in Section 5-10.E - Detention Ponds shall apply to granular media vaults. The presettling basin may be included as a chamber in the vault that provides flow control, or may be contained in a separate structure.
2. Inlet bypass and flow spreading structures shall be designed to minimize turbulence and spread slow evenly across the surface of the filter bed. The maximum distance between the top of the spreader and the top of the sand bed shall be 8 inches. Flows may enter the sand bed by spilling over the top of the wall into a flow spreader pad or alternatively a pipe and manifold system may be used. A pipe and manifold system must retain the required dead storage volume in the first cell and be readily maintainable.
3. The minimum pipe diameter for an inlet pipe and manifold system shall be 8 inches. Multiple inlets are recommended to minimize turbulence and reduce local flow velocities.
4. Erosion protection must be provided along the first foot of the sand bed adjacent to the spreader. Geotextile fabric secured on the surface of the sand bed, or equivalent method, may be used.
5. Vehicular access designed for AASHTO HL-93 (Load Resistance Factor Design method) loading or greater shall be provided for the sediment removal area. Access adequate for maintenance shall be provided directly over a closed sediment removal structure.
6. A v-shaped bottom, removable bottom panels, or equivalent sludge handling system shall be used. One foot of sediment storage in the presettling cell must be provided.
7. The presettling chamber must be sealed to trap oil and trash. This chamber is usually connected to the sand filtration chamber through an invert elbow to protect the filter surface from oil and trash.
8. If a retaining baffle is necessary for oil/floatables in the presettling cell, it must extend at least one foot above to one foot below the design flow water level. Provision for the passage of flows in the event of plugging must be provided. Access opening and ladder must be provided on both sides of the baffle.

F. Flow Restriction and Oil Pollution Control Structures

- As applicable, standards and specifications for flow restriction and oil pollution control structures in Section 5-10.F - Detention Ponds shall apply to granular media filters.

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to granular media filters, as applicable.

H. Weirs Used For Flow Control

- As applicable, standards and specifications for weirs used for flow control structures in Section 5-10.H - Detention Ponds shall apply to granular media filters.

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to granular media filter vaults.
2. Closed filter systems located where vehicle loads may be imposed shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater.
3. Granular media filter vaults for private land development projects shall not be located in the public right-of-way. However, such vaults may be located in a private tract or easement, including those for a private road, subject to a determination by the County Engineer that the private road will not likely be converted to a public road in the future.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

5-18 UNDERGROUND INFILTRATION STRUCTURES

Underground infiltration structures are prefabricated underground structures used for infiltration, typically installed under pavement or other developed surfaces. They typically are so small as to not allow entry by people and so do not have human access specifications such as those for detention vaults.

A. General

1. Underground infiltration structures shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall underground infiltration structures be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
2. Underground infiltration structures shall not be placed in fill.

3. Underground infiltration structures for private land development projects shall not be located in the public right-of-way. Such structures may be located in private roads subject to a determination by the Engineer that the private road will not likely be converted to a public road in the future.
4. Energy dissipaters and level spreader trenches for outflow dispersion, if required, shall conform to the requirements of Section 5-05.M of these Standards.

B. Berms

- RESERVED

C. Concrete / Structural Elements

- Underground infiltration structures shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater when located in the right-of-way or in areas where the structures may be subject to vehicle loads. All design loads shall include an impact allowance in accordance with the AASHTO Standard Specifications for Highway Bridges.

D. Drains / Liners / Geotextile Materials

1. Unless otherwise specified, materials and methods shall conform to WSDOT Standard Specifications.
2. Aggregate surrounding and underlying the underground infiltration structure shall be washed crushed aggregate between 3/4 inch and 2 inches, unless otherwise specified by the vault manufacturer.

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins/inlet control structures in Section 5-10.E - Detention Ponds shall apply to underground infiltration structures.
2. Vehicular access designed for AASHTO HL-93 (Load Resistance Factor Design method) loading or greater shall be provided for the sediment removal area. Access adequate for maintenance shall be provided directly over a closed sediment removal structure.

F. Flow Restriction and Oil Pollution Control Structures

- RESERVED

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to underground infiltration structures.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to underground infiltration structures.
2. Underground infiltration structures for private land development projects shall not be located in the public right-of-way. However, such structures may be located in a private tract or easement, including those for a private road, subject to a determination by the County Engineer that the private road will not likely be converted to a public road in the future.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

5-19 OIL / WATER SEPARATORS

(Standard Drawing: 5-310, 5-315 and 5-230)

Oil/water separators are underground structures, usually housed in concrete vaults, intended to remove petroleum from water primarily by gravimetric separation. The two common configurations are the baffle type, often referred to as the API (American Petroleum Institute) type, and the coalescing plate (CP) type. Oil/water separators typically consist of three bays: forebay, separator section, and afterbay. The CP separators need considerably less space for separation of the floating oil due to the shorter travel distances between parallel plates. Refer to Standard Drawings 5-310 and 5-315.

Spill control separators, which consist of a simple catchbasin with a tee inlet, are not discussed in this section. Information about appropriate applications of oil/water separators is provided in Volume V, Chapter 11 of the Drainage Manual.

A. General

1. Oil/water separators shall not be located within 200 feet of the top of an erosion hazard area or landslide hazard area, as defined by Subtitle 30.6 SCC, unless a geotechnical analysis shows that no slope instability will result. Under no circumstances shall oil/water separators be located within 50 feet of the top of an erosion hazard area or landslide hazard area.
2. Oil/water separators for private land development projects shall not be located in the public right-of-way. Oil/water separators may be located in private roads subject to a determination by the Engineer that the private road will not likely be converted to a public road in the future.
3. Additional standards, specifications, and design criteria are set forth in Volume V, Chapter 11 of the Drainage Manual.

B. Berms

- RESERVED

C. Concrete / Structural Elements

1. Structural plans for all vaults shall be prepared and stamped by a professional engineer licensed in the State of Washington. The drawings shall include steel placement block-outs for inlet and outlet pipes, corner reinforcement, top attachment, water stops, construction joints, and design mix specifications for the concrete.
2. If the vault is to be covered with soil at project completion, the vault shall be designed for saturated soil loading with a minimum cover of two (2) feet. The design shall be adequate for live loads, dead loads, and seismic loads in accordance with the International Building Code, as amended and adopted as the Snohomish County Building Code. Vaults shall be watertight and constructed with 3000 psi minimum compressive strength reinforced concrete.
3. Closed vaults shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater when located in the right-of-way or in areas where the lids may be subject to vehicle loads. All design loads shall include an impact allowance in accordance with the AASHTO Standard Specifications for Highway Bridges.
4. The minimum internal height in a closed vault shall be seven (7) feet, the minimum internal width shall be four (4) feet, and the maximum depth from ground elevation to the vault bottom shall be twenty (20) feet.
5. The walls of all vaults shall have horizontal and vertical reinforcement on each face. Reinforcement shall be designed for both the hydrostatic pressure of a tank full of water and the earth pressure of the planned backfill plus any surcharge. The design of corners of vaults shall take into consideration the restraint provided by the adjoining walls and/or the lids.
6. Maintenance access and ventilation shall meet county, state and national standards. Closed vault ventilation shall be provided by a venting manhole cover or catchbasin grate.
7. Vaults shall have access openings positioned a maximum of 50 feet from any location within the vault, with a minimum of three access points. A ladder shall be provided to the bottom of each cell or compartment. Access points shall be located over the inlet/outlet and the sediment trap. Access shall consist of a round, locking ring and cover in accordance with Standard Drawing 5-230. The ladder shall be directly under the ring and cover. Access design shall provide sufficient clearance between walls and appurtenances to allow access for personnel and required safety and maintenance equipment.

D. Drains / Liners / Geotextile Materials

- RESERVED

E. Presettling Basins / Inflow Control Structures

1. Standards and specifications for presettling basins/inlet control structures in Section 5-10.E - Detention Ponds shall apply to oil/water separators. The presettling basin may be included as a chamber in the vault that provides oil/water separation, or may be contained in a separate structure.

2. Vehicular access designed for AASHTO HL-93 (Load Resistance Factor Design method) loading or greater shall be provided for the sediment removal area. Access adequate for maintenance shall be provided directly over a closed sediment removal structure.

F. Flow Restriction and Oil Pollution Control Structures

- RESERVED

G. Emergency Overflow Structures

- Standards and specifications for emergency overflow structures in Section 5-10.G - Detention Ponds shall apply to oil/water separators, as applicable.

H. Weirs Used For Flow Control

- RESERVED

I. Access Roads

1. Standards and specifications for access roads in Section 5-10.I - Detention Ponds shall apply to oil/water separators.
2. Oil / water separators located where vehicle loads may be imposed shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater.
3. Oil/water separators for private land development projects shall not be located in the public right-of-way. However, oil/water separators may be located in a private tract or easement, including those for a private road, subject to a determination by the County Engineer that the private road will not likely be converted to a public road in the future.

J. Fencing

- RESERVED

K. Vegetation

- RESERVED

CHAPTER 5 STANDARD DRAWING INDEX

EDDS Standard Drawing No.	Title	REPLACED BY WSDOT Standard Plan No./Other Source
5-010	Shoulder Ditches	
	Interceptor Ditch and Checkdam	BMP C207 1/
5-030	Yard Drain Connections	
	Pipe Zone Bedding and Backfill	B-55.20-00
	Beveled End Sections	B-70.20-00
5-060	Pipe/Culvert Outfall Discharge Protection Pad	
5-070	Grass Swale Dispersion System	
5-080A	Level Spreader Trench – PVC	
5-080B	Level Spreader Trench – Concrete	
5-080C	Level Spreader Trench Notes	
5-085	Diffuser Tee	
5-090	Debris Barrier	
	Catchbasin Type I	B-05.20-00
	Catchbasin Type 1-L	B-05.40-00
	Catchbasin Type 1-P	B-05.60-00
	Catchbasin Type 2	B-10.20-00
	Catchbasin Type 2	B-10.20-00
	Concrete Inlet	B-25.60-00
5-120	Catchbasin Details	
	Manhole Type 1	B-15.20-00
	Manhole Type 2	B-15.40-00
	Manhole Type 3	B-15.60-00
	Manhole Type 4	DELETED
5-170	Manhole Details	
	Rectangular Frame (Reversible)	B-30.10-00
	Rectangular Solid Metal Cover	B-30.20-01
	Rectangular Vaned Grate	B-30.30-00
	Rectangular Bi-Directional Vaned Grate	B-30.40-00
	Combination Inlet	B-25.20-00
5-220A	Rolled Curb Frame & Grate 2/	
5-220B	Rolled Curb Frame & Grate Installation 2/	
5-225	Rolled Curb Vaned Grate 2/	
5-230	Manhole Ring and Cover	
5-240A	Typical Detention Pond	
5-240B	Typical Detention Pond Sections	
5-245	Overflow Structure	
5-250A	Flow Splitter, Option A	
5-250B	Flow Splitter, Option B	
5-260	Flow Restrictor (Baffle)	
5-265	Flow Restrictor (Weir)	
5-270A	Flow Restrictor/Oil Pollution Control - T Restrictor Notes	

5-270B	Flow Restrictor/Oil Pollution Control - T Restrictor	
5-270C	Oil Pollution Control Catchbasin (5-240C)	
5-275	Flow Restrictor/Oil Pollution Control - T Shear Gate Detail (5-250)	
5-280	Typical Detention Vault	
5-290	Typical Detention Tank	
5-295	Detention Tank Access Detail	
5-300A	Sand Filter Vault	
5-300B	Sand Filter Vault	
5-310	API Separator (Baffle type)	
5-315	Coalescing Plate Separator	

1/ Located in the Snohomish County Drainage Manual.

2/ For replacement of existing frames and grates only; not for new installation.

CHAPTER 6
BRIDGES

6-01 GENERAL

Except as modified below, new public and private road bridges and associated structures in Snohomish County shall be designed and constructed to meet the minimum requirements set forth in the latest edition, including all interim addenda, of the AASHTO LRFD (Load Resistance Factor Design) Bridge Design Specifications and the WSDOT Bridge Design Manual, in that order of precedence.

The AASHTO Standard Specifications for Highway Bridges, 17th edition, may be used for the maintenance and rehabilitation design of older, existing public and private road bridges and structures.

Designers of private bridges are encouraged to schedule a pre-design meeting with the Departments of Planning and Development Services and Public Works to discuss design proposals.

6-02 PEDESTRIAN BRIDGES

Bridges that will carry pedestrian and bicycle traffic shall be designed in accordance with AASHTO's Guide Specifications for Design of Pedestrian Bridges.

6-03 BRIDGE DESIGN ELEMENTS

See Standard Drawings 6-010, 6-020, 6-030A and 6-030B

A. General

1) Bridge design proposals shall address the elements listed below, as a minimum, for review by the Engineer.

2) The Engineer may direct that other design criteria, such as the bridge rehabilitation criteria set forth in the WSDOT Local Agency Guidelines, be applied under appropriate circumstances.

B. Geometrics

1) The bridge roadway shall comprise the full width and configuration of the road being served: travel lanes plus curbs, sidewalks, walkways, bike lanes, and/or shoulders on one or both sides. Accommodation shall be made for utilities, including likely future improvements. See Standard Drawings 6-010 and 6-020.

2) Bridge width shall be measured between the curbs or between the faces of the bridge railings, whichever is less. The minimum bridge widths shall be the following in order to match the approach road widths:

   - Public road - 28 feet.
   - Private road - 20 feet.

3) Urban area bridges shall have a 5-foot wide sidewalk on each side of the roadway. Planter strips are not required. Refer to Standard Drawing 6-010.

4) Where operating speeds are 35 mph or higher, and significant bike and/or horseback traffic can be expected, the Engineer may require that facilities for these other modes of travel be separated from the traffic lanes by a bridge rail.

5) Overhead vertical clearance for motor vehicles, including overpasses, shall be 16.5 feet minimum. Vertical clearance above a walkway, sidewalk, equestrian trail or bikeway shall be 10 feet minimum.

6) Bridge height shall provide at least 3 feet of clearance between the bottom of the deck and the 100-year flood elevation.

7) Span length shall be sufficient so that no in-stream piers are required.

8) Bridge abutments shall be located well behind the ordinary high water elevation (OHWE) to minimize construction impacts.

C. Approach Profile

1) A bridge shall not be located at the low point of a sag vertical curve to prevent accumulation of stormwater runoff on the bridge.

2) The width and superelevation of the bridge shall match the approach roadway.

D. Load Requirements

1) All vehicular bridges shall be designed to carry an AASHTO HL-93 (Load Resistance Factor Design method) live load or greater.

2) All new bridges shall be designed for actual dead load and superimposed dead loads, such as utilities, pavement and bridge railings. The following minimum superimposed dead loads shall be used in design:

   - Utilities: 120 pounds per linear foot, per utility line
   - Two-inch asphalt overlay: 25 pounds per square foot.

3) Bridges for pedestrian and/or bicycle traffic shall be designed for a live load of 85 pounds per square foot.

E. Approach Slabs

1) Approach slabs are required for all bridges. Approach slabs shall be constructed in accordance with Standard Drawings 6-030A and 6-030B, or an approved individual design. The requirement for approach slabs may be waived only by deviation approved by the Engineer based on a geotechnical analysis.

2) All new bridge plans shall provide pavement seats for approach slabs, unless otherwise approved by the Engineer.

3) Approach slabs shall have a minimum length of 10 feet and shall be the full width of the roadway, including curbs, gutters, sidewalks or walkways as applicable.

F. Piers

1) Piers for new bridges shall be located above the ordinary high water elevation and shall be founded on piles or drilled shafts unless it can be demonstrated that there is little scour potential.
2) Bridge piers and diaphragms shall have openings for existing and future utilities.

G. Decks

1) Bridge decks shall have threaded inserts for existing and future utility installations.
2) All reinforcing steel in concrete bridge decks shall be hot-dip galvanized steel.

6-04 SPECIAL REQUIREMENTS

Construction or reconstruction of bridges may require permits from agencies such as the Coast Guard, Army Corps of Engineers, Department of Ecology, or the Department of Fish and Wildlife, among others. It is the project applicant's responsibility to obtain all necessary permits.

6-05 GUARDRAILS AND RAILINGS

See Standard Drawings 6-010, 6-020, 6-040

A. General

1) Bridge approach guardrails are generally required at all four corners of each bridge. Refer to Standard Drawings 6-010 and 6-020 for typical approach guardrails for urban and rural bridges.
2) Approach guardrails and bridge railings shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications and the WSDOT Bridge Design Manual and Standard Plans. An acceptable bridge railing option is provided in Standard Drawing 6-040.
3) Approach guardrails shall be made structurally continuous with bridge railings.
4) All exposed structural steel in bridge railings shall be hot-dip galvanized steel.

CHAPTER 6 DRAWING INDEX

CHAPTER 7
ROAD CHANNELIZATION, ILLUMINATION AND SIGNALS

7-01 CHANNELIZATION

See Standard Drawings 7-010 through 7-170

Snohomish County's standard pavement markings for channelization of roadways are shown in Standard Drawings 7-010 through 7-170. Except as may be noted on these drawings, pavement markings and signage in Snohomish County follow the current edition of the Manual of Uniform Traffic Control Devices (MUTCD), published by the Federal Highway Administration, and the Standard Plans for Road, Bridge and Municipal Construction, published by the Washington State Department of Transportation.

Pavement markings and signage for private development projects will be installed by the County unless approved otherwise. Scheduling and arrangements are made as part of the construction plan review process.

7-02 ROAD ILLUMINATION

A. General

1) Illumination of transportation facilities enhances the visual perception of conditions or features that require additional driver or pedestrian alertness. A properly designed illumination system provides safety for motorists and pedestrians and enhances security for parking facilities.

2) The responsibility for illumination of transportation facilities belongs to the agency or party responsible for the roadway. That is, the County is responsible for illumination of county public road facilities while the State Department of Transportation is responsible for illumination of state highways.

3) Illumination standards and design criteria are provided in Chapter 8 of the WSDOT Design Manual. The County Traffic Engineer may be contacted for additional information.

4) All illumination design for existing county roads shall be approved by the Engineer. Such designs shall become the property of Public Works with entitlement to an electronic copy of the plans.

B. Illumination Levels

1) Two levels of illumination are defined, with appropriate locations listed below:
    - "Basic illumination" is required at the following facilities:
    - Channelized intersections
    - Signalized intersections
    - Transit stops
    - Parking lots
    - Railroad crossings with automatic gates
    - Pedestrian undercrossings or overcrossings
    - Curbs and hard channelization
    - Medians and landscape planters
    - Urban arterials
2) "Illumination beyond basic" may be installed at the following facilities provided the warrant conditions listed in the following section are met and the Engineer grants approval:
    - Signalized intersections where video traffic detection is installed
    - Railroad crossings within the 95 percentile queue of a traffic signal
    - Traffic calming devices
    - High accident locations
    - Unchannelized intersections
    - Roadway tunnels
    - Railroad crossings without gates
    - Trail crossings
    - Raised pedestrian crosswalks
    - Speed humps
    - Multi-lane arterials
    - Roadways adjacent to high traffic generators

C. Illumination Warrants

1) General:
    i. The nighttime peak hour volume shall be used to determine the level of service for illumination analysis.
    ii. Nighttime traffic volume warrant analysis shall use traffic counts taken after 4:30 p.m. and before 7:30 a.m.

iii. Illumination may also be warranted by accident rates. The ratio of nighttime to daytime accidents should be at least 1.5 times higher than the ratio for comparable locations. A study should be conducted to verify that illumination will reduce nighttime accidents.

2) Warrants:

- High Speed Roadways

High speed is defined as 40 miles per hour or greater. Illumination beyond basic is warranted when the level of service for the nighttime peak hour is D or worse and two or more of the following conditions are satisfied:

i. Three or more successive signalized intersections have an average spacing of 700 feet or less.

ii. The roadway is within an urban growth area boundary.

iii. The lighting algorithm warrant is met. Refer to the "Intersection Lighting Evaluation" of the USDOT Roadway Lighting Handbook, Implementation Package 78-15, Form 2 or contact Public Works' Traffic Operations.

3) Channelized Intersections

- Illumination of intersections is warranted if any of the following conditions occur:

i. The approach level of service during the nighttime peak hour is D or worse.

ii. The lighting algorithm warrant is met.

- Low Speed Roadways

Low speed is defined as less than 40 miles per hour. Illumination beyond basic is warranted if the area is classified as intermediate and the level of service for the nighttime peak hour is D or worse or if the nighttime accident warrant is met.

- Arterials

Illumination is warranted at all channelized intersections along arterials. Continuous illumination is warranted if the level of service for the nighttime peak hour is D or worse or if the nighttime accident warrant is met.

- Unchannelized Intersections

Illumination of unchannelized intersections is warranted if channelization warrants are met or if the nighttime accident warrant is met.

- Tunnels

Daytime illumination is warranted if portal conditions result in a brightness reduction greater than 15 times and the length to vertical clearance ratio is ten to one or greater. Underdeck illumination is required if pedestrian facilities are present. A light meter measurement is required to justify the installation of daytime illumination in existing tunnels.

- Construction Zones

Nighttime construction activities on the roadway may warrant illumination. Illumination requirements shall be determined by the Engineer on a case-by-case basis.

- Detours

Detour alignments and grades that are unusual or result in unexpected maneuvers warrant illumination. Illumination requirements will be determined by the Engineer on a case-by-case basis.

- Bridges

Warrants for illuminating bridges are the same as those for high or low speed roadways, whichever is applicable. Underdeck and bridge deck illumination is required if pedestrian facilities are present.

- Railroad Crossings

Illumination of railroad crossings is warranted if there is a potential for nighttime accidents. The extent of nighttime train activity should be taken into consideration.

- Pedestrian Facilities

Areas in which a high level of pedestrian activity occurs or is expected to occur may warrant illumination. Additionally, security problems may justify the installation of nighttime lighting.

- Trails

Illumination is warranted if security problems have developed or are anticipated. Requirements will be determined by the Engineer on a case-by-case basis.

7-03 SIGNALS

A. General

1) A pre-design conference is required with the County Traffic Engineer for any proposal to install a traffic signal. A signal warrant analysis is required for each new traffic signal installation. Preparation of the warrant analysis shall conform to the applicable sections of the MUTCD. The warrant analysis shall be submitted to the Traffic Engineer for consideration before any design work is submitted.

2) The Engineer has approval authority for all traffic signal installations. The following documentation shall be submitted to Traffic Operations and approved before a signal installation will be considered.
   - Signal Warrant Analysis
   - Design Report
   - Preliminary Signal Plan
   - Final Plans, Specifications and Estimates (PS&E)
3) The designer shall submit plans, specifications, and estimates at 30%, 60%, 90%, and 100% plan completion stages. Detailed requirements are provided in Table 7-1.

   i. An electronic copy of the plans and base, in the County's current CADD format, must be approved with the final plans. It is recommended the electronic copy be submitted early in the design process for review and comment.

   ii. The 30% design shall show channelization including all turning radii and stop bar locations, existing utilities, phasing diagram, pole locations, controller location, signal head displays, loop layout, sidewalk ramps and preliminary illumination design. Because channelization is critical to signal design, the channelization plan shall be approved by the Traffic Engineer prior to the 30% plan submittal.

   iii. The 60% design shall show, in addition to the 30% requirements, wire notes, construction notes, general notes, pole schedule, foundation elevations (pole foundations, controller/service foundations, and any other constructed foundations), wiring diagrams, service cabinet details, miscellaneous details, special provisions and a preliminary estimate.

   iv. The 90% design shall show, in addition to the 60% design, a complete set of plans, special provisions and estimates.

   v. Final 100% plans, special provisions, and estimates shall incorporate all comments from Snohomish County and be complete before approval will be granted. An electronic copy of the plans and base in the County's current CADD format shall be submitted with the final plans for approval.

   vi. If an interim signal system is needed during construction, a temporary signal plan shall be submitted with the 30%, 60%, 90%, and final submittals.

Table 7-1: Submittal Schedule

SUBMITTAL	PLANS	CHANGES REQUIRING APPROVAL
30%	Channelization (including turning radii and stop bar locations) Existing Utilities Phasing Diagram Pole Locations Controller Location Signal Head Displays Loop Layout Sidewalk Ramps Preliminary Illumination Design Temporary Signal Plans	
60%	Wire Notes Construction Notes General Notes Pole Schedule Foundation Elevations Wiring Diagrams Service Cabinet Details Miscellaneous Details Special Provisions Preliminary Estimate Temporary Signal Plans	Channelization Pole Locations Loop Layout Signal Head Displays
90%	Complete Set of Plans Special Provisions Estimate Temporary Signal Plans	Utilities
Final	Final Plans Special Provisions Estimate Electronic Copy of Plans Temporary Signal Plans	

B. Signal Design

1) General design criteria are contained in Chapter 8 of the WSDOT Design Manual and Chapter 4 of the MUTCD as adopted and modified by WSDOT. The County Traffic Engineer shall provide specific design criteria and guidance for signal design.

2) Emergency vehicle preemption systems are required for all signals. The preemption system shall be capable of identifying and logging specific preempting vehicles in a manner compatible with existing preemption system transmitters.

CHAPTER 7 DRAWING INDEX

CHAPTER 8
UTILITIES AND OTHER RIGHT-OF-WAY USES

8-01 GENERAL

All activities using Snohomish County public right-of-way for other than transportation are subject to the provisions of SCC Title 13 (Roads and Bridges), which regulates these activities through the franchise and right-of-way (R/W) use permit processes. Detailed franchise and right-of-way use permit requirements are contained in SCC Title 13.

Utility providers desiring to construct and/or maintain their facilities within County right-of-way are required, under SCC Chapter 13.80, to obtain a franchise with Snohomish County unless specifically exempted by state law or excepted in accordance with SCC 13.80.010. The Engineer shall make determinations on single-use or minimal-use facilities.

Accommodation of utilities and other activities within the right-of-way shall be in such a manner so as not to materially degrade or adversely affect traffic operations, safety, maintenance or the structural integrity of the roadway. The size of disturbed area necessary to install a utility facility shall be kept to a minimum. Utilities and other right-of-way use activities are subject to Snohomish County codes relating to drainage, erosion/sedimentation control and environmental protection unless exempted by state law.

8-02 UTILITY LOCATION

See Standard Drawings 8-010, 8-020

A. General

1) Utility facilities shall be located to minimize the need for future relocation to accommodate roadway improvements and to provide service access to such facilities with minimum disruption to roadway traffic. Franchise holders and permittees are encouraged to contact Public Works concerning long-range county road improvement plans to minimize potential project conflicts.

2) Utility equipment or facilities to be installed in the right-of-way shall not disrupt the operation of existing utilities. Gravity systems, whether sanitary sewer or storm drainage, shall have precedence over other systems in design and construction. Other utilities, including but not limited to electrical, telephone, cable TV and fiber optic lines, are preferred for underground installation at locations compatible with other utilities, storm drains and future roadway construction. Refer to Standard Drawings 8-010 and 8-020.

8-03 ABOVEGROUND UTILITIES

A. Location

1) The location of poles, vaults, boxes or other aboveground utility objects shall be compatible with driveways, intersections, and other roadway features. They shall not interfere with sight distance, signage, traffic signals, drainage facilities, etc. Where possible, utilities shall share facilities to minimize the number of obstructions in the right-of-way.

2) The placement of aboveground utility facilities or equipment within the right-of-way shall conform to the "clear zone" and "control zone" guidelines published in the WSDOT Design and Utilities Manuals respectively. The standards are the same and the respective labels are used on the drawings for the Road Design and Utilities chapters: "clear zone" on Standard Drawings 3-010, 3-020, 3-040 and 3-050; "control zone" on Standard Drawings 8-010 and 8-020. The distances shown apply to roads with a posted speed of 35 mph or less.

   For posted speeds greater than 35 mph, clear zone and control zone distances are specified in Chapter 710 of the WSDOT Design Manual and Appendix 5 of the WSDOT Utilities Manual, respectively.

3) Utility poles and other aboveground utility equipment shall be placed outside of clear zone/control zone areas unless a deviation is approved by the Engineer. Utility poles and equipment shall not be placed in pedestrian or bicycle facilities, or protrude into the vertical space over sidewalks, walkways or bikeways. As specified in the WSDOT Design Manual, there shall be an unobstructed vertical clearance of at least 7 feet above the surface of any sidewalk or walkway and 8 feet above any bikeway.

B. Overhead Utility Lines

1) The minimum vertical clearance for overhead power and communication lines above the road and the minimum lateral and vertical clearance from bridges shall comply with the Washington State Department of Labor and Industries Electrical Construction Code.

2) Where irregularly shaped sections of right-of-way extend beyond the standard right-of-way limits, a uniform alignment of facilities shall be acceptable as approved by the Engineer.

8-04 UNDERGROUND UTILITIES

See Standard Drawings 8-010, 8-020

A. Location

1) A pre-design conference is required with the Public Works' Land Use Section for any proposal to install utilities underground in any existing arterial road right-of-way or in more than 2000 feet of an existing non-arterial road right-of-way, excluding any activities covered by a blanket utility construction permit (Type D7) pursuant to SCC 13.60.020(7). Documentation of the pre-design conference (see Appendix C) shall be submitted with the right-of-way use permit application. Final approval of all utility installations within the road right-of-way rests with the Engineer.
2) Longitudinal placement of underground utilities in the right-of-way shall comply with the typical utility locations shown in Standard Drawing 8-010 or 8-020.
3) Lateral placement of underground utilities across a right-of-way shall be as near a right angle to the road centerline as practicable. Utility crossings should avoid deep cuts, bridge footings and retaining walls, or locations where roadway drainage would be affected. Utility placement may be designated by the Engineer.
4) Underground utilities shall be located at least 5 feet from road centerline and where they will not otherwise disturb existing survey monumentation.

B. Cover and Separation

Cover over underground utilities and the separation between underground utilities shall conform to applicable federal and state regulations, WSDOT/APWA Standard Specifications and these Standards.

C. Casings

1) Casings shall be installed for roadway crossings when required by appropriate industry codes or by the Engineer. Casings may be required in the following situations:
    - To facilitate the insertion, removal, replacement, or maintenance of a carrier line crossing or other circumstances where it is necessary to avoid open trench construction.
    - To protect carrier lines from external loads or shock during or after construction of a road.
2) To protect jacked or bored installation of coated carrier lines unless assurance is provided that no damage will result.
3) Within the right-of-way, casing pipes shall extend to the outside of curbs or ditches or beyond the toe of fill slopes.
4) Casing pipes shall be sealed at both ends, except for necessary vents and/or drains.

D. Carrier Pipes

Carrier pipes, pipes directly enclosing a transmitted fluid or gas, shall conform to the material and design requirements of the appropriate utility industry and governmental codes and specifications.

Carrier pipes shall be designed to withstand road loading plus all loads imposed thereon under all ranges of operating pressure from zero to maximum internal pressure.

E. Marking

Location markers and emergency information shall be provided by the utility when required by applicable state and federal standards.

F. Individual Service Lines

1) Individual water service lines shall:
   - be placed in the right-of-way only as necessary to make side connections.
   - be placed so that their length within the right-of-way is minimized.
2) Meter boxes shall be set at the inside edge of the right-of-way line, but not within curb ramps. Where a utility easement exists adjacent and parallel to the right-of-way, meter boxes shall be placed in the utility easement.
3) Septic tank effluent lines shall:
   - Have a minimum inside diameter of 2 inches.
   - Be encased in cast or ductile iron pipe.
   - Be placed with a minimum of 4 feet of cover from the lowest roadside feature (i.e. bottom of ditch), within 10 degrees of deflection from a perpendicular line to road centerline and shall extend to outside the right-of-way line. Private easements shall be used for installation parallel to the right-of-way line.
   - Be jacked or bored under the roadway unless otherwise approved by the Engineer.
   - Not exceed a length within the right-of-way of 60 feet or the minimum width of the existing right-of-way, whichever is larger.

G. Appurtenances

1) Vents may be required for casings, tunnels and galleries enclosing carriers of fluids or gases in accordance with federal, state or local standards. Vent standpipes shall be located as close to the right-of-way line as possible to minimize interference with road operation and maintenance, and shall not be concealed by vegetation.

2) Drains may be required for casings, tunnels or galleries enclosing carriers of fluids or gases in accordance with federal, state or local standards. Drains for carriers of hazardous materials shall be directed to artificial holding areas to prevent possible surface or groundwater contamination. Drains for which only water or other non-hazardous liquids may discharge may be directed into roadway drainage systems at locations approved by the Engineer. The drainage outfall shall not be used as a waste way for routine purging of the carrier pipe unless specifically authorized by the Engineer.

3) Manholes shall be designed and located in a manner that will cause the least interference to other utilities or future road expansion. Where practicable, installations in the pavement or shoulders shall be avoided.

8-05 UNDERGROUND UTILITY INSTALLATION

See Standard Drawings 8-030, 8-040

A. General

1) The WSDOT/APWA Standard Specifications, particularly Sections 5-04, 7-08.3(3) and 9-01 through 9-03, shall apply unless otherwise stated below. Applicable federal and state regulations regarding trench safety shall be met.

2) Pavement cuts in roads that have been reconstructed or resurfaced with an asphalt overlay (Class B ACP) within the past three (3) years shall not be allowed unless a deviation is approved by the Engineer. Further discussion is provided in Subsection B, "Installation," below.

3) Prior to construction, the contractor/utility may be required to submit a proposed haul route for review by the Engineer. Based on this review, the Engineer may require that a haul route agreement be administered by Public Works in accordance with SCC Title 13.

4) All utility trenches to be constructed outside of the improved right-of-way (existing road and fill slope) shall undergo appropriate environmental review to ensure all impacts to wetlands, streams, fish and wildlife habitat areas and buffers are adequately mitigated.

B. Installation

1) Lateral trenching in roads that have been reconstructed, or resurfaced with an asphalt overlay within the past 3 years, shall not be permitted unless it is shown that alternatives, such as boring or jacking, are not feasible.

2) Where boring is the required installation method:

   i. The length of the bore shall extend a minimum of 4 feet from edge of pavement, if sufficient right-of-way exists.

   ii. Unused holes or abandoned casings shall be backfilled.

   iii. Water boring under roadways shall not be permitted.

   iv. Existing carriers and conduit installed under a roadway shall be physically located prior to boring.

3) When trenching through existing pavement, the open cut shall be a neat-line cut made by either saw-cutting or jackhammering a continuous line. Trench sides shall be kept as nearly vertical as possible.

   i. Trench width shall equal the diameter of the pipe plus a minimum of 12 inches on each side to ensure adequate compaction by mechanical means. See Standard Drawing 8-030.

   ii. Where a trench crosses pavement, the pavement cut shall be at least 12 inches wider on each side than the width of the trench to ensure adequate compaction.

4) The pipe or carrier, including backfill, shall be installed in a manner that ensures no deformation of the pipe likely to cause leakage or degradation to the structural integrity of the roadway. Compaction and restoration shall be accomplished as detailed below immediately after the trench is backfilled.

5) Plowing of communication and electrical lines on or adjacent to existing roads by means of a vibratory plow may be allowed by the Engineer provided the structural integrity of the roadway will not be impaired. Plowing may be no closer than 4 feet from the pavement. Use of a "static" type plow is not allowed.

C. Restoration Requirements

1) Trenches Parallel To Road Alignment (Longitudinal Trenches)

   i. All trench backfill shall be per WSDOT/APWA Specification 7-08.3(3) and these Standards, using bank run gravel or CSTC conforming to Specifications 9-03.19 or 9-03.9(3), respectively. Backfill shall be spread in successive layers not exceeding 6 inches in loose thickness. Each layer shall be compacted with mechanical tampers to 95 percent of maximum density as determined in ASTM D1557.

   ii. After placing a tack coat on the existing asphalt edges, the final patch shall be constructed with 6 inches of compacted depth of Class B ACP or 2 inches of Class B ACP and 4 inches of ATB placed in the trench cut up to finished grade.

iii. After 6 months or after all settlement has occurred, a full width overlay consisting of 2 inches compacted depth of Class B ACP shall be placed over the full width of the road and extended 10 feet longitudinally from each patch end. When overlaying an existing asphalt road, the ends of the overlay project and any areas where matching existing curb or pavement will be necessary, shall be pre-ground in preparation for the 2-inch overlay. Should the final patch not be of satisfactory surface texture and grade, an asphalt pre-level shall immediately be done to ensure a smooth driving surface during the period before the final asphalt overlay.

2) Trenches Transverse To Road Alignment (Lateral Trenches)

i. All trench backfill shall be per WSDOT/APWA Specification 7-08.3(3) and these Standards, using bank run gravel or CSTC conforming to Specifications 9-03.19 or 9-03.9(3), respectively. Backfill shall be spread in successive layers not exceeding 6 inches in loose thickness. Each layer shall be compacted with mechanical tampers to 95 percent of maximum density as determined in ASTM D1557. Controlled Density Backfill may be required by the Engineer in accordance with Section 8-07 of this chapter.

ii. Backfill shall be placed to within 8 inches of existing road grade and after tack coat preparation, a compacted thickness of 8 inches of Class B ACP or 2 inches of Class B ACP and 6 inches of ATB shall be placed to finished grade.

iii. After 6 months or after all settlement has occurred, a full width overlay of 2 inches compacted depth Class B ACP shall be required where multiple pavement cuts have been made by the same utility, 200 feet or less apart. The overlay shall extend 10 feet longitudinally beyond the outside edges of the outermost trenches. Should the final patch not be of satisfactory surface texture and grade, an asphalt pre-level shall immediately be done to ensure a smooth driving surface during the period before the final asphalt overlay.

1) Any trench in a roadway that is to be resurfaced by the County Overlay Program within 12 months shall be backfilled with bank run gravel or CSTC, compacted to 95% of maximum density, or with Controlled Density Fill (CDF) when required by the Engineer in accordance with Section 8-07 of this chapter, to minimize settlement. The backfill shall be covered by temporary asphalt as specified in Section 8-05.C.(1).ii or 8-05.C.(2).ii above.

4) Water settling of backfill in trenches under existing roadways is not permitted.

5) Temporary restoration of trenches for overnight use shall be accomplished by using cold mix, ATB, or steel plates. ATB used for temporary restoration may be dumped directly into the trench, bladed out, and rolled. After rolling, the trench shall be filled flush with asphalt to provide a smooth riding surface. Asphalt materials used for temporary patching must be removed prior to placement of the permanent patch.

6) Final patches shall conform to the requirements of this chapter and shall be completed as soon as possible but no later than 30 days after first opening the trench. Any delay in placement of the final patch shall be approved by the Engineer.

7) Window cuts are subject to the patching but not the overlay requirements of this chapter.

8) Concrete pavement shall be restored in accordance with Section 5-05 of the WSDOT/APWA Standard Specifications. If concrete panels in an existing road are cut by a trench, the Engineer may require removal of the panels to ensure road stability.

9) Gravel shoulders disturbed by excavation shall be replaced full width with 6 inches of crushed surfacing top course (CSTC) meeting the specifications of Section 9-03.9(3) of the WSDOT/APWA Standard Specifications.

10) Any cut made in permeable pavement shall be restored with the same permeable pavement. This is to ensure that project design assumptions for infiltration through permeable pavement are not invalidated by pavement changes after installation. Restoration shall be performed by contractors qualified either by previous experience (at least three permeable pavement projects within the past five years) or certification by an appropriate trade organization, such as the National Ready-Mix Concrete Association. Porous concrete shall be restored in accordance with ACI 522.1-08 ("Specification for Pervious Concrete Pavement," published by the American Concrete Institute); other permeable pavements in accordance with manufacturer's specifications.

D. New Roads

Backfill compaction for new road construction should be accomplished by mechanical compaction per WSDOT/APWA Specifications. Compaction up to the top 2 feet of a trench by water settling may be done provided the entire water-settled portion of the trench reaches 95% maximum density and the top 2 feet of the trench consists of Controlled Density Fill as specified in Section 8-07 of this chapter.

E. Testing

Consistent with the above requirements and prior to placing any surface materials on the roadway, it shall be the responsibility of the utility/developer/contractor to provide density test reports certified by a professional engineer licensed in the State of Washington.

A minimum of 1 density test shall be taken within every 200 feet of trench length and at depths of 50 percent of trench depth and at the surface, or as specified by the Engineer. Compaction of laterals or service line trenches shall be tested where required by the Engineer. Certified copies of all test results shall be provided to the County.

F. Notification and Inspection

1) Consistent with Chapter 9 of these Standards, any developers, utilities, or others intending to trench in existing or proposed county right-of-way shall notify the Department of Planning and Development Services Inspection Section not less than 3 working days prior to performing the work. This notification shall include:
   - Location of the work
   - Permit number
   - Method of compaction to be used
   - Day and hour when compaction is to be done
   - Day and hour when testing is to be done
2) As set forth in Chapter 9, failure to notify may necessitate testing or retesting by the County at the expense of the developer or utility. At the Engineer's discretion, the work may be suspended pending satisfactory test results.

G. One Call System

1) Underground utilities shall comply with Title 19 RCW, Chapter 19.122 ("Underground Utilities"). For reference purposes, the Underground Utilities Location Center phone number is 1-800-424-5555.
2) If work is to be performed within 750 feet of a signalized intersection, the utility shall notify Public Works Traffic Operations at (425) 388-6420 at least 2 working days prior to start of construction.

8-06 UTILITY INSTALLATION ON ROADWAY STRUCTURES

A. General

1) Attachment of utility lines to a roadway structure, including bridges, may be allowed where such attachment conforms to sound engineering practice for preserving the roadway structure and ensuring its safe operation, maintenance and appearance. Attachment of any utility to any bridge within the county road right-of-way requires the approval of the County Bridge Engineer.
2) Attachment of a utility shall not be considered unless the structure is designed to support the additional load and can accommodate the utility facility without limiting features such as ease of maintenance.
3) Utility features, such as manholes or access panels, shall not be placed within the roadway portion of the structure.
4) A pipeline carrying a hazardous substance shall not be attached to a roadway structure unless specifically approved by the Engineer.

5) The utility attachment shall not reduce any clearance requirement of the structure. Attachment to the outside of a structure shall be avoided unless there are no reasonable alternatives.

6) Utility mountings shall be of a type that does not create noise from vibration.

7) Any hole created in a structure abutment shall be sleeved, be of a minimum size necessary to accommodate the utility line, and be sealed to prevent any leakage of water or backfill material.

8) A utility line behind an abutment shall curve or angle out to align outside the roadbed area in as short a distance as is operationally practicable.

9) Communication and electrical power line attachments shall be suitably insulated, grounded, and preferably carried in protective conduit or pipe from point of exit from the ground to re-entry. Carrier pipe and casing pipe shall be properly isolated from electric power line attachments.

8-07 CONTROLLED DENSITY FILL (CDF)

A. General

1) Controlled Density Fill (CDF) may be required by the Engineer in lieu of native backfill material in situations where even a small amount of trench settlement cannot be tolerated, such as installation of transverse trenches on arterial roads.

2) CDF shall be used as fill above pipe zones at all street crossings and other areas, as specified by the Engineer, where consolidated, non-settling backfill is required to prevent settlement. The Engineer may limit the use of CDF in cases where trenching has penetrated the till layer and disruption of natural groundwater flow would occur.

B. Composition

1) CDF shall be a mixture of Portland cement, fly ash, aggregates, water and admixtures which have been batched and mixed in accordance with WSDOT/APWA Standard Specifications.

Table 8-1 CDF Composition

CDF COMPOSITION	
Portland Cement	AASHTO M 85 or WSDOT/APWA 9-01
Fly Ash	Class F
Aggregates	WSDOT/APWA 9-03.1(2)B
Water	WSDOT/APWA 9-25
Admixtures	WSDOT/APWA 9-23.6

2) CDF shall be used in the following proportions for each cubic yard. Batch weights may vary depending on specific weights of aggregates. CDF shall be batched to provide a pourable, non-segregating mix, with a slump between 6 inches to 8 inches.

Table 8-2 CDF Proportions

CDF PROPORTIONS	
Mixing Water per Cubic Yard	50 gallons max.
Cement per Cubic Yard	40 pounds
Fly Ash per Cubic Yard	250 pounds
Dry Aggregate per Cubic Yard (Class 1 or 2 Sand as per WSDOT/APWA 9-03.1(2)B	3200 pounds

C. Placement

1) CDF shall be discharged from the mixer by any reasonable means into the area to be filled. The CDF shall be brought up uniformly to the elevation shown on the plans.

2) CDF shall not be placed on frozen ground. CDF patching, mixing, and placing may be started if weather conditions are favorable and the temperature is at least 34 degrees F. and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop if the temperature drops to 38 degrees F. or less. Each filling stage shall be as continuous a process as possible.

3) Trench sections to be filled with CDF shall be contained at either end of the trench section by bulkheads or earth fill. The contractor shall provide steel plates to span the utility trenches and prevent traffic contact with the CDF for at least 24 hours after placement or until the CDF is hard enough to prevent rutting by construction equipment or traffic.

4) Where a trench will be filled with CDF and covered by asphalt, a 4-inch to 6-inch layer of CSTC shall be placed between the CDF and the layers of ATB and ACP.

D. Compaction

For pourable CDF, compaction is not necessary for placement. The contractor may, as an option, adjust the water content only to obtain a 1-inch maximum slump mixture that shall be compacted in lifts not to exceed 12 inches. Compaction shall be accomplished by a manually operated vibratory plate/compactor.

8-08 FINAL UTILITY ADJUSTMENT TO FINISH GRADE

A. General

1) All utility covers, valve boxes, manholes and monument cases located on asphalt roadways shall be temporarily placed at subgrade elevation prior to placing base material.

2) Final adjustment of all covers and access entries shall be made following final paving by:

- Saw-cutting or neat-line jackhammering of the pavement around lids and covers. The opening should not be larger than 12 inches beyond the radius of the cover.
- Removing base material, surfacing course, and frame; adding raising bricks; replacing frame and cover to finish grade.
- Pouring 5 inches of concrete around the structure and frame within 2 inches of the top.
- Filling the remaining 2 inches with Class B ACP hot mix, compacted and sealed to provide a dense, uniform surface.
- The maximum height differential from the finished grade and top of frame shall not exceed one-quarter inch.

8-09 RESTORATION REQUIREMENTS

See Standard Drawing 8-040

A. Preservation, Restoration and Cleanup

1) All work shall comply with Subtitle 30.6 SCC, "Environmental Standards and Mitigation."
2) Where utility installation or other construction has impacted streams, wetlands, fish and wildlife habitat areas or their buffers, full restoration and/or mitigation shall be performed as required by franchise, permit or county code.
3) Restoration methods shall be in accordance with county codes, provisions of a franchise, permit, or agreement, and/or these Standards.
4) Unsatisfactory restoration of the right-of-way, as determined by the Engineer, shall be promptly corrected by the utility. If necessary, unsatisfactory restoration may be corrected by the County and billed to the utility.
5) Reinforcement, protection and security of existing utilities and facilities under construction are the responsibility of the permit holder.
6) In roadway restoration, the design shall consider the protection of existing utilities without sacrificing the geometrics of roadway design.

B. Traffic Control and Public Safety

1) Traffic controls, including detours for utility work, shall conform to the most current edition of the MUTCD and any other requirements by the County Traffic Engineer.
2) All construction and maintenance operations shall be planned to minimize interference with traffic flow. On heavily traveled roads, no activities interfering with traffic flow will be allowed during peak hours. Work shall be planned so that closure of intersecting streets, road approaches, or other access points is minimized.
3) Adequate provisions shall be made to safeguard any open excavation or construction site, including barricades, lights, flaggers, or other protective features in accordance with the requirements of the Washington State Department of Labor and Industries.
4) The storage of materials, including spoils, on roadways shall not be allowed unless identified on the traffic control plan with appropriate protective measures. Parking of construction or personal vehicles on roadways shall be kept to a minimum.
5) Any signing or mailboxes removed during construction shall be replaced daily. Temporary signing and channelization may be required.

C. Emergency Repairs

If emergency repairs disturb the right-of-way, the right-of-way shall be restored immediately. Approval of the final restoration of the right-of-way shall be obtained from the County as quickly as possible.

D. Striping Replacement

All traffic striping and walkway delineation removed during a construction project shall be replaced. Temporary striping shall be used on a limited basis and only as approved by the Traffic Engineer. All permanent striping and channelization shall be installed by County forces at the expense of the utility or permit holder. If County forces are unavailable to perform the striping installation within an appropriate timeframe, the utility or permit holder shall contract for the striping installation. Traffic Operations shall be contacted at least 2 days in advance of installation to verify channelization layout.

E. Final Cleanup

1) The responsible utility or permit holder shall care for adjacent areas in compliance with Sections 1-04.11 "Final Cleanup" and 8-01 "Erosion Control" of the WSDOT/APWA Specifications.
2) Roadways shall be cleaned and swept both during and after utility work.
3) Disturbed soils shall be final graded, seeded, and mulched after installation of the utility facilities or equipment. In limited areas, seeding and mulching by hand, or sod placement using approved methods, will be acceptable. Ditches lined with erodible soil and subject to rapid flows may require seeding, jute matting, netting, placement of sod, or rock lining to control erosion.
4) Any silting of downstream drainage facilities, whether ditches, pipes or catchbasins, which results from the utility installation shall be cleaned out and restored to proper operation as part of the site cleanup.
5) Any existing storm drainage facilities or roadside features damaged during repair or restoration activities shall be replaced with new materials by the permit holder or their subcontractor.

CHAPTER 8 DRAWING INDEX

CHAPTER 9
CONSTRUCTION CONTROL AND INSPECTION

9-01 GENERAL

A. Plans and Reports

1) Work performed in the construction or improvement of County roads shall be done to the satisfaction of the Engineer in accordance with approved plans. No work may be started until such plans are approved and required permits are obtained. Revisions to construction plans shall be approved by the Engineer prior to implementation.

2) A copy of the approved construction plans and a copy of the Snohomish County Engineering Design and Development Standards (EDDS) are required to be on the construction site at all times.

3) It shall be the responsibility of the permit applicant/developer to provide the Engineer with test reports, certified by a professional engineer licensed in the State of Washington, to verify compliance of materials used in the project. Sampling and/or testing shall be at a frequency and magnitude determined by the Engineer. All costs incurred for sampling, as required, shall be the responsibility of the developer. Test reports shall be submitted to Planning and Development Services for transmittal to the Engineer.

4) All construction activities and materials shall comply with environmental regulations and permits.

B. Haul Route Agreements

1) Haul route agreements may be required for new or expanded commercial hauling within the right-of-way for activities such as development construction, pit and quarry operations, logging or other commercial operations that are anticipated to cause extraordinary damage or accelerated deterioration to county roads.

2) If required by the Engineer, the permit applicant shall submit a proposed haul route for review by the Engineer prior to the start of hauling activities. Based on review of the proposed haul route, the Engineer may require a haul route agreement in accordance with SCC Chapter 13.40.

9-02 SUBDIVISION/COMMERCIAL DEVELOPMENT INSPECTION

A. General

1) The County shall inspect all road and drainage facility construction, and utility installation, relating to subdivision and commercial development.

2) Construction events that require notification to, monitoring and/or inspection by the County are:

- Preconstruction Conference

  Three working days' prior notice is required. A preconstruction conference shall precede the start of construction and shall include the contractor, design engineer, utilities, and other parties affected. Approved plans, including the traffic control plan, and permits are required prior to the conference.

- Clearing and Temporary Erosion/Sedimentation Control

  Three working days' notice is required prior to initial site work involving drainage and installation of temporary water retention/detention and siltation control.

- Storm Drainage Installation

  Two working days' notice is required prior to trenching and placing of storm drainage facilities. A preliminary record drawing of the storm drainage system is required upon completion of the installation and must be approved by the County before the final lift of ACP can proceed. Two weeks shall be allowed for review of preliminary drainage record drawings.

- Subgrade Approval

  Two working days' notice is required. Underground utilities and roadway grading shall be complete, including placement of gravel base. Inspection shall include review and approval of any density tests and certifications submitted in accordance with section 9-04.

- Curb and Sidewalk Forming

  Two working days' notice is required for verification of proper forming and grade preparation prior to pouring concrete. Subgrade approval is required prior to this step.

- Curb and Sidewalk Placement

  Two working days' notice is required prior to placement of concrete. Subgrade approval is required prior to this step.

- Crushed Surfacing Placement

  Two working days' notice is required for verification of placement and compaction of any crushed surfacing base course or top course. Subgrade approval is required prior to this step.

- Paving

  Three working days' notice is required prior to paving with asphalt or Portland cement concrete. Approval of the storm drainage record drawings and subgrade is required prior to paving.

- Structural

  Three working days' notice is required prior to each critical stage such as placing foundation pilings or footings, placement and assembly of major components, and completion of structure and approaches.

- Final Inspection

  Fifteen working days' notice is required prior to overall inspection of project site. All construction shall have been completed, including but not limited to paving, drainage and associated appurtenances, concrete work, erosion control, cleaning of drainage system, and site cleanup.

9-03 FAILURE TO NOTIFY FOR INSPECTION

Notification by the permit applicant of the construction events described above is essential for verification of compliance with these Standards. Failure to notify in a timely manner may require the County to arrange appropriate sampling and testing after-the-fact, with certification by a qualified private testing laboratory or by Public Works. The cost of such testing and certification shall be borne by the permit applicant.

The Engineer may prohibit or limit further work on development construction until all required tests have been completed and corrections made to the satisfaction of the Engineer. If necessary, the County may take further action as permitted by law.

9-04 CONSTRUCTION CONTROL

A. General

1) The provisions of Section 2-03 of the WSDOT/APWA Standard Specifications shall apply in all respects to development construction unless otherwise specified by the Engineer.
2) For County projects, standards for construction are contained in the project specifications.

B. Compacting Earth Embankments

Compaction of the top two feet of fill subgrade shall meet a minimum 95% of maximum density in accordance with the WSDOT/APWA Specifications Section 2-03.3(14)C - Method B. Subgrade fill below the top two feet shall be compacted to 90% of maximum density.

C. Testing and Certification

1) Prior to placing any surfacing material on the roadway, the developer/contractor shall provide density test reports certified by a professional engineer licensed in the State of Washington. Optimum moisture content and maximum density shall be determined by methods cited in Section 2-03.3(14)D of the WSDOT/APWA Specifications.
2) In subgrade areas, a minimum of one test per 200 linear feet per lane shall be taken in a random pattern. Test locations in cut sections shall be taken at subgrade. For work to be accepted, and prior to paving, tests must show consistent uniform density in conformance with these Standards.
3) Density testing for asphalt pavement shall be one test per 400 linear feet per lane, taken in a random pattern. The Engineer may specify more rigorous testing, and may require the contractor to core the pavement to verify depth and density.
4) Density requirements for trenches are provided in Chapter 8 of these Standards.
5) Prior to acceptance by the County, the developer shall provide certification by a registered engineer as to:
    - Quality and density of embankment materials and trench backfill materials.
    - Quality, thickness and density for all surfacing and base materials for both roads and sidewalks.
    - Quality of concrete and concrete items.

D. Other Requirements

1) A preliminary record drawing, stamped and signed by the applicant's surveyor, shall show all drainage features installed as required prior to paving. The drawing must be approved by the County before the final lift of asphalt can proceed.
2) Prior to any site construction involving clearing, logging, or grading, the site/lot clearing limits shall be located and field identified on the approved plans. The applicant and the contractor are responsible for erosion or sediment control that may affect water quality on the project site. A water quality monitoring program may be required.

9-05 TRAFFIC CONTROL

A. Interim Traffic Control

1) The developer/contractor shall be responsible for interim traffic control during construction on or along county roadways. The developer/contractor shall submit a traffic control plan to Public Works and receive approval prior to commencement of any construction.

2) Traffic control shall follow the provisions of section 1-07.23 of the WSDOT/APWA Specifications. All barricades, signs and flagging shall conform to the requirements of the MUTCD and these Standards. Signs must be legible and visible and should be removed at the end of each workday if not applicable outside construction hours.

3) A "Temporary Signing and Channelization Plan" may be required by the Engineer for installation of temporary roadway striping, channelization and/or signing during project construction. Approval is required prior to any installation.

4) All temporary barricades and traffic control measures installed for a private development project shall be removed prior to final plat recording or as otherwise determined by the County.

B. Road Closures, Lane Closures and Detours

1) Road closures, lane closures and detours are subject to the requirements of SCC Chapter 13.40. If unavoidable, the applicant/contractor shall submit a right-of-way use permit application to Public Works. A traffic control/detour plan shall accompany the completed application and shall comply with the MUTCD and WSDOT/APWA Standard Plans and Specifications.

2) Worksite signing, flagger locations, intersections and facilities shall be identified on the traffic control/detour plan. Permit approval is required prior to closing any county right-of-way. The applicant/contractor is also responsible for posting appropriate traffic control signs at least 5 days prior to the road closure.

3) Snohomish County shall make the initial road closure/lane closure/detour notification to the affected jurisdictions, however, the applicant/contractor may be required to update local fire and school districts, law enforcement authorities, Community Transit, and any other necessary parties regarding the progress of the road closure.

9-06 COUNTY ROAD PROJECT INSPECTION

Inspection of county road projects shall be carried out as directed by the Engineer.

9-07 UTILITY NOTIFICATION

RCW 19.122.030 requires that any excavator, before commencing any excavation other than agricultural tilling less than 12 inches in depth, shall notify all owners of underground facilities through a one-number locator service. The utility One-Call Center phone number shall be prominently displayed at any worksite. Refer to Section 8-05.F of these Standards.

If work is to be performed within 750 feet of a signalized intersection, the applicant/contractor shall notify Public Works Traffic Operations at (425) 388-6420 at least 2 working days prior to the start of construction.

CHAPTER 10
CONSTRUCTION PLAN REQUIREMENTS

10-01 CONSTRUCTION PLAN SUBMITTAL

A. General

1) Construction plan requirements are established in County Code. Construction plans shall be signed, sealed and submitted by the applicant's engineer to Planning and Development Services (PDS).

2) Any revisions to approved construction plans shall be submitted to PDS for approval prior to construction. Revisions shall be stamped and signed by the applicant's engineer.

3) Revisions to approved construction plans shall be submitted and approved by the Engineer for compliance with code requirements and standards. Proposed revisions shall be indicated on a copy of the original approved construction plan set that includes the "Approved for Construction" stamp, signed by PDS and the applicant's engineer.

4) The proposed revision shall be clearly shown by strikeout of text, cross-out of items and/or clouding as appropriate, and by posting the drawing revision block.

5) Copies of the proposed plan revision shall be submitted to PDS for review by the County. Once the County approves the revision, it will be added to the approved plan set and, if applicable, a copy will be forwarded to Public Works for filing.

10-02 PLAN STANDARDS

A. Requirements

Submittal, formatting, copying processes, and drawing standards are as follows:

1) Plan sheets submitted to the County for review and approval shall be 24 inches by 36 inches or 22 inches by 34 inches. Plans shall be dark line on light background, plotted or copied on standard drafting paper. Project plan submittals shall include:
   - Two sets of road plans and profiles.
   - Two sets of drainage plans and a drainage report pursuant to Chapter 30.63A SCC.
2) Plans shall not be accepted for reviews that are not clear, concise, or easy to read with all lettering and lines legible.
3) The drawing plan set shall include all offsite road, walkway, drainage and utility improvements, as well as any mitigation or landscaping plans. A temporary erosion and sedimentation control plan, showing the control measures intended to minimize the effects of erosion due to construction operations, shall be included.
4) A schedule of all drawings showing sheet number and title is required on the cover sheet. The cover sheet shall include a vicinity map oriented with North to the top of the sheet, at an appropriate scale showing major roadways and cities.
5) A listing of general notes, containing the specifications and design standards, and storm drainage general notes.
6) All construction plan sheets shall have the county project number clearly marked on the lower right hand edge. Plats shall also have the name of the plat clearly marked on the lower right hand edge.
7) When approved record drawings are required to be filed with Public Works, they shall be drawn in black ink on 4 mil polyester drafting film (mylar) or to an acceptable standard approved by the Engineer.

10-03 HORIZONTAL PLAN

A. General

1) The following elements are required on horizontal plans:

- A vicinity map shall be placed on the cover sheet at an appropriate scale to show the proximity of the project to major roadways and cities.
- North arrow at the top of the page.
- Road alignments with 100 feet stationing reading from west to east or south to north and stationing at points of curve, tangent, and intersections with ties to sections and/or quarter corners surrounding the improvement.
- Section, township, range, and breakdown to boundaries of subdivision.
- Bearings and distances on centerlines based on the Washington State Coordinate System.
- Curve data, including radius, delta, arc length, and tangent distance on all horizontal curves.
- Centerline of handicap ramps shall be identified by the delta and offset stationing. Stationing shall identify mid-block ramps.
- Right-of-way lines and width for existing and proposed roads and intersecting roads. Right-of-way lines on submitted plans can only be depicted by a licensed surveyor pursuant to Chapter 18.43 RCW.
- All easements.
- All topographic features, including but not limited to driveways, fences, trees, signs, mail boxes and other appurtenances within the right-of-way limits and sufficient area beyond to resolve questions of setback, slope, drainage, access onto abutting property and road continuations.
- All existing utilities and proposed utilities to the extent that these will be engineered or relocated by the developer.
- All roads shall be identified by the County road grid numbering system including names, with appropriate designation (street, drive, etc.) and quadrant. Names of adjoining subdivisions, will be shown if applicable.
- Existing and proposed drainage features, indicating location (station & offset), direction of flow, size, and kind of each drainage channel, pipe, and structure. For earthwork, show cuts and fills, new toe of slope and top of bank.

- Scale should generally be 1 inch = 50 feet. However, it may be necessary to show details and even mainline at other scales such as 1 inch = 30 feet or 1 inch = 40 feet to clarify features such as retention/detention systems, frontage improvements, etc. Bridge plans should be drawn at 1 inch = 20 feet to illustrate details.
- When the plan view covers more than one sheet, the first sheet shall show the complete area of the plat with street and lot numbers at a convenient scale, with adjacent road names clearly shown.
- Stationing shall indicate mailbox locations. Any relocation of existing or installation of new mailboxes shall be approved by the Postal Service as discussed in EDDS Section 4-13.
- All street illumination shall be located by stationing on the plans. Note that street lighting may be designed by the local utility or others and shown on a separate plan.
- Datum used and all bench marks, which refer to established control when available, NGVD Datum (1929), or NAVD 88. When NAVD 88 is used, an equation for conversion to MSL (NGVD 29).
- Vertical curb cuts shall be called out by stationing and width.
- On channelization and signing plans, illumination and signal design shall be specific to the project and consistent with Chapter 7 of these Standards.
- All streams, wetland and critical areas and their buffers within 100 feet of the right-of-way.

10-04 PROFILE ELEMENTS

A. General

Profile elements shall include the following:

1) Original ground lines at 100-foot stations and at significant ground breaks and topographic features, with accuracy to within 0.1 foot on unpaved surfaces and 0.02 foot on paved surfaces.
2) Existing utilities, including elevations.
3) Final road and storm drain profile with centerline stationing the same as the horizontal plan, reading from left to right in most cases, to show stationing of points of curve, tangent, and intersection of vertical curves, with elevations to 0.01 foot.
4) Grades accurate to 0.01 percent.
5) Superelevation criteria where utilized.

6) The ratio of the vertical scale to the horizontal scale shall be 1V:10H. That is, the vertical scale shall be 1 inch = 5 feet where the horizontal scale is 1 inch = 50 feet. An exception is for bridge plans which should have horizontal and vertical scales of 1 inch = 20 feet to illustrate features.

7) Vertical curve data, including design speed and required sight distance.

10-05 ENGINEERING RECORD DRAWINGS

A. General

1) Record drawings (previously known as "as-built" plans) are required as specified in County Code. Record drawings are necessary as a basis to plan and design future projects in the same location and to make repairs to damaged structural components or other non-working facilities. Final record drawings submitted to Public Works for archiving shall adhere to the mylar standard set forth in EDDS 10-05.C.

2) Engineering record drawings are a record of any deviations or changes to the original intended physical product of the approved construction plans. The revisions shall be shown on a copy of the original approved construction plans that are filed with the County. Record drawings submitted for county review shall reflect the same degree of detail as the original plan drawings.

3) Record drawings submitted for review and approval shall include, but not be limited to, the following details:

- Roadway centerline profiles and slopes; vertical and horizontal curves; and roadway widths.
- Curb ramps.
- All pipe slopes.
- All catchbasins and manholes, inverts of inlet and outlet, rim elevations.
- All detention pond elements including elevations of any overflow structures, bottom of pond elevations at each corner and center, intake and outlet pipes, elevations at every 25 feet inside and outside of toe of berm and top of berm.
- Control structure elements including size and elevation of all orifices, standpipe notches, bottom of structure, bottom of lid.
- Elevations on dispersion trenches at all pipe inlets and outlets.
- Finished grade of areas changed by grading, with either spot elevations or new contours with actual top and toe of slopes.

B. Record Drawings Submittal Process

To facilitate the approval process of record drawings, the following procedure shall be followed when the mylar standard is required.

1) The applicant shall first submit a paper copy of the record drawings for County review. The record drawings shall be done on a copy of the original approved construction plans.
2) The County will review the drawings and redline any necessary changes. The applicant shall then resubmit a paper copy of the revised record drawings to the County for approval.
3) Upon County approval of the paper copy of the record drawings, the applicant shall then submit the final record drawings on mylar in accordance with the mylar standards set forth in EDDS 10-05.C. The final record drawing shall clearly indicate the "as-constructed" state of the project.

C. Media Standards

1) Final record drawings required by Public Works for archiving shall be original documents produced in a manner that ensures durability, resistance to damage from use or exposure to water or light, and that any alteration is detectable. Record drawings shall be of suitable quality for producing legible prints through scanning, microfilming or other standard copying procedure.
2) Processes used to create record drawings are changing with new technologies. Acceptable processes include black ink on 4 mil polyester drafting film (mylar), photographic mylar, mylars created using an ink jet printer process, or other processes approved by the Engineer. The following criteria shall be used to evaluate acceptability:
    - Substrates (such as polyester, polyethylene or polypropylene) shall be durable and capable of producing copies without loss, distortion or transfer of print or images.
    - Ink shall be pigmented and ultraviolet (UV) resistant.
    - Drawing materials shall ensure a stable, reproducible document for a minimum of 50 years to comply with record retention requirements.
3) Unacceptable processes include, but are not limited to, the following:
    - Mylars that have material affixed by adhesive.
    - Electrostatic mylars (such as a xerographic process) or mylars created by heat sensitive electrostatic plotting.
    - Ammonia process (sepia type) mylars.
4) Plan sheets shall be 24 inches by 36 inches or 22 inches by 34 inches, dark line on light background.

10-06 ALTERNATE MATERIALS AND METHODS

Where alternate materials are permissible (different types of storm sewer pipe, etc.) they shall be clearly called out on the road construction plans.

Where leak testing (see Section 5-04.I) for sewer pipe is deemed necessary by the Engineer or by the developer's engineer, it shall be determined during the design/review process prior to approval of plans for construction and shall be clearly called out on the road construction plans.

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APPENDIX C